Hurricane Message Enhancement

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FOREWORD

This study represents an effort to determine what best stimulates people to respond to hurricane information in ways that will maximize their safety.

I am deeply indebted to the members of the advisory panel, who contributed both time and insight. Their comments and suggestions led to many of the significant conclusions reached in this study. The panel members were:

Walter Anderson, executive officer, Southern Region National Oceanic and Atmospheric Administration, National Weather Service, Southern Regional Headquarters, Fort Worth, Texas

Davis Benton, former director, National Weather Service, Galveston, Texas

Clint Dare, director, Insurance Information Institute, Austin, Texas

Sally Davenport, former administrator of Technical Programs, Texas Coastal and Marine Council, Austin, Texas

Capt. Samuel Early, Ret., former director, Galveston Marine Affairs Council, Galveston, Texas

Dr. Neil Frank, director, National Hurricane Center, Coral Galves, Florida

Robert Lansford, coordinator, Governor's Division of Disaster Emergency Services, Austin, Texas

Herbert S. Lieb, former chief, Disaster Preparedness, U.S. Department of Commerce, NOAA, National Weather Service, Silver Springs, Maryland

Dr. Joe Moseley II, former director, Texas Coastal and Marine Council, Austin, Texas

Cecil Palmer, meteorologist in charge, Houston Area, National Weather Service, Alvin, Texas

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Dr. Robert H. Simpson, Simpson Weather Associates, Charlottesville, Virginia

Dr. Gilbert F. White, director, Institute of Behavioral Sciences, Boulder, Colorado

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Other contributors include Dr. Larry Christensen, associate project director, whose background in experimental psychology contributed to the success of the study and Dr. Jimmy Newell of the Psychology Department of Galveston Junior College, who assisted in preparing for some of the experiments; the administrators of both Galveston Community College and Texas A&M University at Galveston for the use of their facilities and Walter Anderson, who contributed significantly to the development of the simulated hurricane.

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Carlton Ruch

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CHAPTER I. INTRODUCTION

Because of the rapid increase of population along coastlines and the congestion and related problems that increase creates, it becomes more critical each year for persons to respond promptly to hurricane warnings, especially warnings to evacuate. Additional egress roads are not being built at the rate the population increase demands. This trend, coupled with the capricious nature of hurricanes to deposit large amounts of rainfall and spawn tornadoes which can cut off already over-crowded egress routes, makes a major catastrophe possible when a hurricane strikes.

In an effort to determine what specific tactics and information would encourage people to respond to warnings, certain subject areas were investigated. The areas were:

1. Simulated hurricane variables
2. Consequences of exposure to hurricane fury via television
3. Influence of other residents, authority figures and events
4. Response as a function of media presentation
5. Response to fear, information and testimony in current hurricane material.

The methodology used was primarily psychological experiments interpreted by statistical analysis. The findings are summarized in a hurricane response model. For easy identification, items specifically used in the model are printed in italics in the text

and labeled with an "M" in the figure and table headings.

Previous research has established several additional ways to increase the probability of people evacuating. Except for one,* these should be considered supplemental to the suggestions provided in the model. The following list is not inclusive, but it does summarize some of the main conclusions:

- The availability of evacuation plans increases the likelihood of evacuation (Perry, 1978).
- People who fail to confirm evacuation messages tend not to evacuate (Perry, 1978).
- Families tend to evacuate as units (Perry, 1978).
- People are more apt to leave if they feel their property will be safe (Perry, 1978).
- Knowledge of the availability of public shelters will prompt more people to evacuate (Perry, 1978).
- People who anticipate greater storm damage are more likely to evacuate (Wilkinson and Ross, 1970; Windham, et al., 1977).
- People who believe weather reports are usually accurate are more likely to evacuate (Baker et al., 1976).
- An expectation of receiving more information can delay decisions (Carter, Clark and Leik, 1979).

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*People who anticipate greater storm damage are more likely to evacuate.

CHAPTER II. STUDY ONE: SIMULATED HURRICANE VARIABLES

Response patterns of humans to hurricanes have been studied mainly by means of post-hurricane interviews. Although such studies are of great value, they have built-in limitations. For example, it is difficult to establish study controls such as random sampling methods and unstressed interview situations. Another limitation is that people are often unaware of the real events which cause them to respond in certain ways, that is, the events they claim had caused certain responses were not the events which, in fact, had caused them (Nesbett and Wilson, 1977).

In this study information was presented to individuals about a simulated hurricane which was named Karen. Then their response patterns and perceptions of danger to this information were monitored. While this methodology protected against the types of shortcomings previously mentioned and allowed for systematic variation of a greater number of variables, it contained a problem of its own: knowing to what extent responses to the simulated hurricane would correspond to responses during an actual hurricane. As a result, in this study the assumption is made that a positive relationship exists between responses made to the simulated hurricane and the responses that would be made during an actual hurricane.

Methodology

Nine variables were incorporated into the simulated hurricane, and their separate impacts on experiment participants were evaluated

by means of response patterns and perceptions of danger. In the order of their appearance to experiment participants, they were: (1) direction of hurricane movement, (2) whether or not the hurricane was stationary, (3) wind speed, (4) movement speed, (5) distance from shore, (6) issuance of a hurricane watch, (7) height of expected storm surge, (8) issuance of a hurricane warning, and (9) issuance of an evacuation notice. To measure each variable separately, the path of the hurricane was made erratic (Figure 2-1).*

In addition to impacts of these nine variables, we measured reactions to: (10) five different hurricane force numbers as described in the Saffir/Simpson Scale (Appendix B), (11) viewing of maps, and (12) origin of message, such as local (Galveston) weather forecasts as contrasted with statements from the National Hurricane Center at Miami, Florida.

To measure these 12 impacts, 20 combinations of the simulated hurricane Karen were developed (Table 2-1). A booklet was prepared for each combination, containing definitions of "storm surge", "hurricane watch", and "hurricane warning", as well as a list of 12 alternative actions progressing from least to most extreme:

A. I would wait for further bulletins.

B. I would do nothing but remain inside the house.

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*Figures 2-1 through 2-42 are shown in Appendix D.

C. I would board up the windows* and remain inside the house.

D. I would board up the windows, tie loose objects down and collect a supply of food and water and wait for further bulletins.

E. I would board up the windows, tie loose objects down and collect a supply of food and water and prepare to ride it out.

F. I would board up the windows, tie down loose objects and move a short distance away from the beach area.

G. I would board up the windows, tie down loose objects and move to a Civil Defense or Red Cross shelter.

H. I would board up the windows, tie down loose objects and evacuate.

I. I would evacuate immediately.

J. I would have already evacuated to a safe area and am awaiting further bulletins.

K. I would have already evacuated but feel there is no future danger, so I am returning home.

L. Other type of response.

Each page of the booklet contained a new bulletin or advisory. Those booklets containing maps showed a map for each advisory and bulletin to ensure easy visibility and reference. Subjects were instructed to indicate their reaction to the information on each page by marking a response sheet according to the directions printed at the top of the sheet. A sample of the response sheet with directions follows:

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*Includes taping and shutters.

HURRICANE KAREN RESPONSE SHEET

Example One: If after you read a hurricane advisory in the yellow booklet you feel it indicates no danger to you and your response would be to merely wait for further bulletins, then indicate this by the following:

Presents No Danger to Me ✓ Presents Extreme Danger to Me

(A) B C D E F G H I J K L If "Other", please specify _____

Example Two: If you feel the advisory indicates extreme danger and you would evacuate immediately, that would be indicated by:

Presents No Danger to Me ✓ Presents Extreme Danger to Me

A B C D E F G H (I) J K L If "Other", please specify _____

Example Three: If you feel the advisory indicates some danger, then indicate that degree of danger by placing a check in the line somewhere between the extremes of "no danger" and "extreme danger". Likewise, if your response would be to board up the windows and remain in the house, then circle "C".

Presents No Danger to Me ✓ Presents Extreme Danger to Me

A B (C) D E F G H I J K L If "Other", please specify

1. Presents No Danger to Me _____ Presents Extreme Danger t o Me

A B C D E F G H I J K L If "Other", please specify _____

Table 2-1

TWENTY SIMULATED HURRICANE COMBINATIONS

COMBINATION	HURRICANE FORCE NUMBER	VIEWING OF MAPS		ORIGIN OF MESSAGE	
		Yes	No	Galveston	Miami
1	1	X			X
2	2	X			X
3	3	X			X
4	4	X			X
5	5	X			X
6	1	X		X	
7	2	X		X	
8	3	X		X	
9	4	X		X	
10	5	X		X	
11	1		X	X	
12	2		X	X	
13	3		X	X	
14	4		X	X	
15	5		X	X	
16	1		X		X
17	2		X		X
18	3		X		X
19	4		X		X
20	5		X		X

For purposes of analysis only, responses "A" through "K" were assigned a numerical value: A = 1, B = 2, C = 3, etc. Both "J" and "K" were considered maximum responses and each was rated 10. The score for "L" (other type of response) was assigned pursuant to analyzing the statement written after "If 'Other,' please specify."

The degree of danger perceived was also scored on a scale from 1 through 10. The line whereon each subject was to check his response was ten centimeters long. The centimeter in which each placed his check mark was the score he received; that is, a check in the third centimeter was scored 3; in the fourth centimeter it was scored 4, and so on.

In addition to the simulated hurricane, four other instruments were developed as means of collecting further data from or about Galveston residents. These are displayed in Appendix C. The first instrument, referred to as the "Telephone Section," was used to gather general information such as past and future actions during hurricanes. It also was the means of making appointments for use of the second instrument in the experiment, the "Interview Section."

During the interviews, more specific information was sought, such as, present status of dependents and property, knowledge of hurricanes and access to already published information, and plans of preparation for hurricanes and evacuation. It was during this phase of the experiment that the interviewee responded on the

"Hurricane Karen Answer Sheet" to the bulletins and advisories contained in the booklet discussed above.

The third instrument for data collection was a "Locus of Control Scale." About one-sixth of those interviewed received a questionnaire designed to determine what each felt basically controlled his life, chance, other people, or himself.

Following the interview, the interviewer completed the fourth instrument, "Observation Section." This included a description of the interviewee's type of residence, such as brick, wood, single or multiple story, or mobile home, his race, sex, and estimated age.

Each of these four instruments was pre-tested using psychology students at Texas A&M University. After a number of revisions, another pre-test was given, this time to residents of Galveston Island.

Interviews

Interviewees were chosen randomly from the Galveston Telephone Directory. The initial goal was to secure 400 interviews in order that each of the 20 combinations of the simulated hurricane could be responded to by twenty individuals 18 years or older.

The interviewers were trained Galveston Community College students, most of whom were permanent residents of Galveston Island and enrolled in statistics classes.

The 20 combinations of the simulated hurricane were randomly distributed to the students. Interviews were set up by geographic

area. Efforts were made to assign black students to predominately black areas. Bilingual students were assigned to individuals with Spanish surnames.

The interviews began in October 1977 and continued through May 1978. In this time, only 177 interviews were completed so some students were retained through the summer of 1978. An additional 113 interviews were completed early in the summer. Because of difficulties in getting residents to be interviewed, and the length of time required to randomly select replacements for those not interviewed, the procedures were modified. A person meeting the age requirement, living in the house either to the left or right of the original randomly selected individual, was interviewed instead. As a result, 91 additional interviews were completed.

Various statistical analyses were run to test for significant variations among the three groups interviewed. The October 1977 through May 1978 group and the two summer groups were compared to discover if there were differences because of the length of time involved for the interviewing process. The last summer group was compared with the earlier two groups to ensure the procedural modification had not influenced the results. Analysis of variance (ANOVA, Appendix A) showed that no statistically significant differences existed among the three groups. Consequently, they were grouped together for a total of 381 completed interviews.

Table 2-2 shows a comparison of population characteristics for the final sample of interviewees with the Galveston population according to 1970 census data. The male-female ratio was fairly consistent, as was household size. Racial characteristics were also consistent except within the "Other" category. Changes in the "Other category represented primarily an increase in the Asian and Oriental populations. The writer believes the Galveston population of these groups has increased considerably since the 1970 census.

Results

The results of the experiment are grouped into three categories. The first is "General Information." Herein is contained information from responses to questions asked by both telephone and personal interviewers. The second category, "Variables in 'Karen,'" includes data collected from responses made to the bulletins and advisories contained in the booklet. Category three, "Factor Effects," combines the first and second categories to show what effect such factors as age and evacuation experience had on responses made to the bulletins and advisories.

Table 2-2

POPULATION CHARACTERISTICS OF INTERVIEW SAMPLE
COMPARED WITH GALVESTON 1970 CENSUS DATA
(By Percentage)

CHARACTERISTIC	GALVESTON 1970 CENSUS	SAMPLE POPULATION
Sex:		
Male	47.8	44.7
Female	52.2	55.3
Race:		
White	69.6	75.0
Black	29.4	21.0
Other	1.0	4.0
Household Size		
1	18.7	24.6
2	26.8	31.2
3	19.5	15.8
4	16.6	11.9
5	8.4	7.0
6	5.0	4.1
7	5.0	5.4

General Information

According to Table 2-3-M, *71.2 percent of the sample population had some form of hurricane experience.* Of these, 85.1 percent recalled Carla as the most severe hurricane they had experienced.* Also, 48.8 percent indicated they had evacuated during a hurricane, but only 24.7 percent of the 48.8 percent had evacuated off the island.

Because of sick or elderly members, 10.5 percent of the households would experience difficulty during evacuation. Employment or other activities could require at least one member, or 25.7 percent of the households, to remain on the island during an evacuation.

Interestingly, 40.6 percent indicated they would not live on the island were it not for the seawall, and *72.5 percent feared tornadoes spawned by hurricanes more than the hurricanes themselves.*

When asked if they would evacuate off the island in the event of a severe hurricane, 67.2 percent of the interviewees indicated they would. Of these, 87 percent would evacuate in their own cars, 37.2 percent would be leaving one or more cars behind, and 33.8 percent would have some member of the household remain behind to protect property. Only 3.3 percent of all individuals interviewed

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* Because of the large number who had experienced Carla, it was not possible to divide the remaining 15 percent into groups having experienced hurricanes of different intensities.

indicated they would evacuate boats, whereas 14.5 percent owned boats. Boat sizes ranged 10-16 feet (45.7 percent), 17-20 feet (34.3 percent) and over 20 feet (20.0 percent). Of all boats, 23.1 percent were kept in the water.

Table 2-3-M

EVACUATION-RELATED DATA FOR SAMPLE POPULATION
(By Percentage)

CATEGORY	PERCENTAGE
Persons with hurricane experience	71.2
Households with elderly or sick persons who would be difficult to evacuate	10.5
Households with a member whose employment or other activities could require him to remain on island during evacuation	25.7
Persons indicating they would not live on an island without the seawall	40.6
Persons indicating they fear tornadoes spawned by hurricanes more than hurricanes themselves	72.5
Persons indicating they would evacuate off the island in the event of a severe hurricane	67.2
Persons indicating they would evacuate their boats	3.3

The most common source (see Table 2-4-M*) for seeking additional hurricane information would be the National Weather service (42.0 percent),* followed by radio (19.6 percent), television (15.7 percent), and newspaper (4.7 percent). This is a summary of responses to question 4 in the "Interview Section" (Appendix C). Interestingly, media sources were preferred over the police, sheriff, or coast guard (3.9 percent); civil defense (3.6 percent); or the Red Cross (1.4 percent).

Table 2-4-M

SOURCES FOR SEEKING ADDITIONAL HURRICANE INFORMATION

SOURCE	SAMPLE POPULATION'S PREFERENCE (%)
National Weather Service	42.0
Radio	19.6
Television	15.7
Newspaper	4.7
Police, Sheriff, or Coast Guard	3.9
Civil Defense	3.6
American Red Cross	1.4
Other (usually specific persons)	9.1

Responses to question 9 in the interview section also relating to sources of information, revealed that, *if reports on a hurricane were conflicting, most persons (67.7 percent) would believe National Weather Service reports rather than reports from other sources (see*

Table 2-5-M). *When conflicting reports were involved, of those who indicated they would believe first the National Weather Service (NWS), 88.5 percent said they would most likely believe the Galveston Office of the NWS compared to 11.5 percent who would believe the National Hurricane Center in Miami, Florida.* Although conflicting official reports are not likely, the question demonstrates more trust in local than national sources.

Table 2-5-M

MOST CREDIBLE SOURCES FOR HURRICANE INFORMATION
IN CASES OF CONFLICTING REPORTS

SOURCE	SAMPLE POPULATION'S PREFERENCE (%)
National Weather Service	67.7
Television	18.2
Radio	10.5
Local Civil Defense	5.9
American Red Cross	2.2
Newspaper	.5

When asked how many feet the tide must rise above normal to block evacuation from the island, 28.9 percent indicated they had no idea (see Table 2-6-M). *It is generally acknowledged that a five- or six-foot tide would stop evacuation off the island. Only 23.3 percent indicated that island evacuation could be blocked by a tide of five feet or less.*

Table 2-6-M

OPINIONS ABOUT AMOUNT OF TIDAL RISE
REQUIRED TO BLOCK ISLAND EVACUATION

AMOUNT OF TIDAL RISE	SAMPLE POPULATION'S OPINION (%)
No idea	28.9
2 feet	1.8
3 feet	2.1
4 feet	5.0
5 feet	14.4
6 feet	11.3
7 feet	8.4
8 feet	4.0
9 feet	2.9
10 feet	6.3
11 - 15 feet	10.4
16 + feet	4.5

The estimated time necessary to evacuate Galveston Island can range from 14 to 26 hours (depending on what assumptions are made)(Ruch, 1981). *Over one-quarter of those interviewed (25.2 percent) had no idea how long an evacuation would actually take (see* Table 2-7-M*), and 28.9 percent thought it would take 6 hours or less.*

Table 2-7-M

OPINIONS ABOUT NUMBER OF HOURS NECESSARY TO EVACUATE ISLAND

NUMBER OF HOURS	SAMPLE POPULATION'S OPINION (%)
No idea	25.2
1 - 6 hours	28.9
7 - 12 hours	13.6
13 - 18 hours	3.7
19 - 24 hours	15.7
25 - 48 hours	10.8
49 + hours	2.1

Interviewees were asked at what point they would consider each of three items of hurricane information: wind speed, feet of water above normal tide, and hours before a hurricane would hit, as indicating to them they were in danger, and then at what point that item of information would cause them to consider evacuating. By the time many respondents would evacuate, the routes would be closed.

The majority indicated that they would wait until winds reached 75-plus miles per hour, or water was five to six feet above normal tides, or there were twelve hours or less before landfall. At that point the only evacuation possible would be to safer places on the island itself.

Table 2-8

OPINIONS ABOUT WINDSPEED, TIDE, AND LANDFALL

ITEM OF INFORMATION	SAMPLE POPULATION'S OPINION (%)	
	It Would Place Them in Danger	It Would Cause Them to Consider Evacuating
Wind Speed		
0 - 24 mph	3.1	1.9
25 - 49 mph	17.3	11.9
50 - 74 mph	35.0	40.5
75 + mph	44.6	46.5
Feet of Water Above Normal Tide		
1 - 2 feet	3.1	3.4
3 - 4 feet	18.8	15.8
5 - 6 feet	30.9	33.5
7 - 8 feet	15.7	18.9
9 - 10 feet	11.8	9.5
11 - 14 feet	10.4	10.7
15 + feet	9.3	8.2
Hours Before Hurricane Would Hit Island		
24 hours	32.5	30.8
18 hours	13.5	14.9
12 hours	26.0	30.7
6 hours	28.0	23.6

Variables in "Karen"

The variables incorporated in the development of the simulated hurricane "Karen", and described in the 28 bulletins and advisories, included the following: direction of movement, whether or not the hurricane was stationary, wind speed, movement speed, distance from shore, issuance of a hurricane watch, notification of potential storm surge, issuance of a hurricane warning, and issuance of an evacuation notification. The general relationship between the response patterns and perceptions of danger for the 28 bulletins is shown in Figure 2-2.*

In the column labeled "Variable Measured," Table 2-9-M lists the order in which the variables appeared in the advisories and bulletins. The two columns entitled "Average Increase From Prior Bulletin or Advisory" show the comparative effects between bulletins for either response pattern or perceived danger. For example, advisory five measured wind speed. The increase in the response pattern of advisory five over advisory four was .15. The two "Probability Level" columns indicate the statistical validity of the differences either as a result of chance or as a result of the bulletins or advisories. The increase was tested using Scheffe's test after analysis of variance. Any score greater than .05 (.06 to 1.00) was considered to mean the increase could have happened by chance. Scores of .05 or lower (.05 to .00) meant that the increase in the variable was a result of the bulletin or advisory.

* Figures 2-2 through 2-44, including "M" figures are displayed in Appendix D.

Table 2-9-M

VARIABLES MEASURED BY RESPONSE PATTERNS
AND BY DEGREE OF DANGER PERCEIVED

ADVISORIES AND BULLETINS	VARIABLE MEASURED	RESPONSE PATTERNS		DEGREE OF DANGER PERCEIVED	
		Average Increase from Prior Bulletin or Advisory	Probability Level	Average Increase from Prior Bulletin or Advisory	Probability Level
1	--	--	--	--	--
2	Distance	.14	.99	.06	1.00
3	Stationary	.19	.91	.12	.99
4	Direction	.10	1.00	(-.04)	1.00
5	Wind Speed	.15	1.00	.06	.99
6	Stationary	.08	1.00	.05	1.00
7	Movement Speed	.07	1.00	(-.01)	1.00
8	Movement Speed	.05	1.00	.07	1.00
9	Movement Speed	.21	.81	.08	1.00
10	Wind Speed	.09	1.00	.04	1.00
11	Stationary	.08	1.00	.11	.99
12	Direction	.19	.86	.20	.61
13	Distance	.39	.01	.41	.00
14	Distance	.32	.26	.32	.00
15	Distance	.56	.10	.53	.27
16	Stationary	.32	.96	.19	1.00
17	Direction	.21	1.00	.08	1.00
18	Watch	.40	.77	.26	1.00
19	Storm Surge	.30	.97	.35	.90

Table 2-9-M (CONT.)

ADVISORIES AND BULLETINS	VARIABLE MEASURED	RESPONSE PATTERNS		DEGREE OF DANGER PERCEIVED	
		Average Increase from Prior Bulletin or Advisory	Probability Level	Average Increase from Prior Bulletin or Advisory	Probability Level
20	Warning	.34	.93	.30	.98
21	Stationary	.15	1.00	116	1.00
22	Movement Speed	.31	.96	.39	.83
23	Evacuation	.63	.04	.65	.03
24	Stationary	.31	.97	.29	.98
25	Direction	.38	.84	.52	.30
26	Distance	.56	.16	.73	.01
27	Distance	.28	.98	.44	.59
28			1.00	.19	1.00

Based on the data in Table 2-9-M, *the only variables which caused statistically significant effects were distance of the hurricane from shore and issuance of an evacuation notice.* From Table 2-9-M, distance has a significant effect on responses in bulletin 13 (.01 level of significance). It has a significant effect on perceptions of danger in bulletins 13 (.00 level of significance), 14 (.00 level of significance), and 26 (.01 level of significance). Evacuation has a signi-

ficant effect on both responses (.04 level of significance) and perceptions of danger (.03 level of significance) in bulletin 23 (the only bulletin in which an evacuation notice was tested as a variable).

It should be noted that statistically significant scores were not figured on average score increases, but on the pattern of all the responses made to one advisory or bulletin compared to all the responses made to the next advisory or bulletin.

Factor Effects

The effects of various factors (such as age of interviewee, past hurricane experience, etc.) on response patterns and on perceptions of danger are displayed in Table 2-10. The statistically significant effects were determined by analysis of variance (ANOVA, Appendix A), using the five percent level of significance, (that is, a probability level of .05 or lower indicated that that factor affected interviewees' reactions). This statistical test was conducted on the first thirteen bulletins which described the early, or pre-threat, stages of the developing hurricane, and on the last fifteen bulletins which described the later, or more threatening stages. Accordingly, statistically significant relationships existed for hurricane force, message origin, hurricane experience, evacuation experience, years lived in Galveston, employment or other activities requiring a family member to remain on the island during evacuation, age, education, type of residential structure, family size, boat ownership, home ownership, home hazard information received, internal locus of control, and powerful others locus of control.

Table 2-10

SIGNIFICANT EFFECTS OF VARIOUS FACTORS ON RESPONSE PATTERNS AND PERCEPTIONS OF DANGER IN A DEVELOPING HURRICANE

PROBABILITY LEVEL OF MEAN DIFFERENCES (ANOVA)

FACTORS	RESPONSE PATTERNS		PERCEPTION OF DANGER	
	Early Stages of hurricane (Bulletins 1-13)	Later Stages of hurricane (Bulletins 14-28)	Early Stages of hurricane (Bulletins 1-13)	Later Stages of hurricane (Bulletins 14-28)
Hurricane Force (Levels 1-5):	.99	.01	.75	.98
Tracking Maps (with; without):	.54	.42	.67	.46
Message Origin (Miami;Galveston):	.04	.48	.24	.32
Hurricane Experience (Yes; No):	.91	.03	.96	.72
Evacuation Experience (Yes; No):	.09	.00	.93	.05
Years Lived in Galveston (10 or less; 10 +):	.98	.00	.97	.12
Employment or Other Activities Would Cause to Remain on Island (Yes; No):	.60	.27	.01	.83
Age (Five Categories):	.05	.07	.15	.99
Sex (Male;Female):	.76	.97	.82	.37
Education (12 yrs or less; 12 + yrs):	.04	.90	.01	.50
Family Income ($13,000 or less About $13,000):	.98	.99	.73	.99
Race (Latin, Anglo, Black, Other):	.95	.93	.32	.50

Table 2-10 (CONT.)

FACTORS	RESPONSE PATTERNS		PERCEPTION OF DANGER	
	Early Stages of hurricane (Bulletins 1-13)	Later Stages of hurricane (Bulletins 14-28)	Early Stages of hurricane (Bulletins 1-13)	Later Stages of hurricane (Bulletins 14-28)
Types of Residential Structure (Six Types):	.04	.18	.35	.02
Size of Family (1-8):	.97	.85	.00	.00
Boat Ownership (Yes; No):	.99	.34	.99	.03
Home Ownership (Yes; No):	.34	.00	.45	.00
Home Hazard Information Given (Yes; No):	.41	.00	.42	.40
Internal Locus of Control (High; Low):	.71	.07	.19	.01
Powerful Others Locus of Control (High; Low):	.04	.99	.95	.80
Chance Locus of Control (High; Low):	.99	.22	.98	.14

Levels of Force

Figure 2-3-M displays the response pattern for the five levels of hurricane disaster potential as described in the Saffir/Simpson Scale (Appendix B). A statistically significant difference of .01 was found among those five levels for responses to the last 15 advisories and bulletins. The greatest difference among average scores for the individual hurricane levels occurred between force one and the other four. The average score for force one was substantially lower than the others, while average scores for forces two through five were closely grouped. This pattern was repeated for perception of danger (Figure 2-4-M): reaction to the first hurricane force was considerably less severe than to forces two through five, which again had closely grouped reactions. Such patterns indicate that people classify hurricanes at levels two through five somewhat the same, that is, they are all bad hurricanes.

Tracking Map Usage

Response patterns and the degree of danger perceived did not differ significantly for those who had access to hurricane tracking maps compared to those who did not (Figures 2-5 and 2-6). The possession of such maps had little influence on either response patterns or perceptions of danger. This finding is consistent with a Florida State University study of Hurricane Eloise, where no significant relationships were found in evacuation patterns of

individuals who kept tracking charts and those who did not (Baker et al., 1976). It should be noted that a difference might have occurred had the location of the hurricane been indicated by a "saw" (or satellite picture) which would have shown the massive nature of the hurricane, rather than the location being indicated by a mere point (see Study Four of this report).

Bulletin Origin

Figures 2-7 and 2-8 display the differences in response patterns and perceptions of danger between those who had the source of their bulletins and advisories labeled as the National Hurricane Center in Miami, Florida, and those who had the source of their bulletins labeled as the National Weather Service in Galveston. A statistically significant difference (.04 level) between the two sources existed for the first thirteen (pre-threat) bulletins, with the Miami Center almost always receiving the highest scores. This is curious because in the questionnaire portion of the interview, individuals indicated they would be more likely to believe information whose source was identified as the National Weather Service in Galveston rather than the National Hurricane Center in Miami.

One possible explanation is that if, according to the questionnaire responses, people put more trust in the National Weather Service in Galveston, then their level of uncertainty would be lower than that of people whose source of information was Miami.

Because of their greater confidence in the information, their safety response patterns and perceptions of danger would not reflect a compensation factor created by information felt to be less reliable. For example, a person who is unsure of reports he hears might evacuate immediately, rather than take the time to tie down loose objects before evacuating, in order to compensate for the possibility that the hurricane was actually closer and more severe than was reported. If he believes the information, he has no need to compensate for possible error.

Hurricane Experience

The influence of hurricane experience on response patterns and on perceptions of danger is shown in Figures 2-9 and 2-10, respectively. The response patterns for those with experience and those without are almost the same for the pre-threat bulletins. During the latter development, however, a statistically significant (.03 level) shift took place: those without experience had higher response patterns than those with experience. In perceptions of danger, those who lacked hurricane experience felt less threatened during the early stages of hurricane development, but more threatened later. A Mississippi State University study (conducted with the National Weather Service) of Hurricane Eloise supports these perceptions. They found that those who had experienced a major hurricane were less likely to evacuate than those who had experienced none or only one of low intensity (Windham et al., 1977).

It would have been interesting to investigate the relationship of intensity of hurricane experience to response patterns and perception of danger. This was not possible, however, since 85.1 percent of the interviewees had experienced Hurricane Carla and the remaining 14.9 percent did not constitute an adequate sample.

The influence of previous hurricane evacuation experience on response patterns and degree of danger perceived can be seen in Figures 2-11 and 2-12. In both figures, those with evacuation experience had statistically significant higher scores. Such responses might have been anticipated since those who already had taken the more extreme reaction of evacuation once would be more likely to do so again, while those who had refused to evacuate in the past would be more likely not to evacuate under similar conditions. In both figures the reaction to the evacuation bulletin (number 23) for those who had evacuated was nearly double that of those with no evacuation experience. During Carla, it was found that residents who had evacuated for previous hurricanes were more likely to have evacuated for Carla (Moore et al., 1963).

Length of Residence

Figures 2-13 and 2-14 compare the response patterns and degree of danger perceived by people who had lived on Galveston Island ten or fewer years compared to those who had lived on the island more than ten years. Both figures show that during the later stages of hurricane development, responses were higher for those who had lived on the

island ten years or less. This was especially true for the response patterns where a statistically significant (.00 level) difference occurred. For some reason, the longer a person lives on the island, the less danger he perceives and the less likely he is to make more extreme responses. This finding, too, is supported by the Mississippi State University study which indicated that people with less than 5-year residency were more likely to evacuate than persons with longer residency (Windham et al., 1977).

Work Requirements

Those persons who indicated that employment or other activities might require them to remain on the island during an evacuation scored slightly lower for both response patterns and perceptions of danger than those without such constraints (see Figures 2-15 and 2-16). In the first thirteen bulletins, the difference for perception of danger was significant at the .01 level.

Age

The influence of age on response patterns is illustrated in Figure 2-17. The .05 level of significance for the early advisories and bulletins, and the .07 level for the later ones is due, in part, to the high response levels of the 40-to 49-year age group, and the unusual response patterns of the 20- to 29-year age group, wherein the responses were low in the beginning but extreme towards the end. The same general patterns, though not as extreme, can be seen in Figure 2-18 for perception of danger. For both response patterns

and perceptions of danger, the 60-plus age group had the lowest scores for the later advisories and bulletins. This was consistent with findings during Carla; that is, residents over 60 were less likely to evacuate (Moore et al., 1976).

Male vs. Female

Figures 2-19 and 2-20 indicate the difference in response patterns and perceptions of danger for males and females. Although none of these relationships was statistically significant, it is interesting to note that the response patterns and perceptions of danger for every bulletin and advisory were higher for females than for males.

Education

The influence of educational level is shown in Figures 2-21 and 2-22. For both response patterns and perceptions of danger, persons with less than a twelfth grade education had statistically significant higher scores (.04 and .01) in the early stages of hurricane development, while in the later stages these more extreme differences ceased.

Income

Figures 2-23 and 2-24 show the influence of income levels. Although no statistically significant relationships were found for either response patterns or perceptions of danger, people with family incomes below $13,000 scored higher for every bulletin and advisory than those with incomes above $13,000.

Race

The differences reflected in the response patterns and perceptions of danger according to race are displayed in Figures 2-25M and 2-26M. Although no statistically significant relationships were found, it should be noted that Blacks generally scored higher than Anglos, Latins, or others (mostly Oriental and Asian). At the same time, *Latins generally scored lower than Anglos, Blacks and others.*

Type of Residential Structure

Statistically significant relationships were found in both response patterns and perceptions of danger for various types of residential structures as seen in Figures 2-27 and 2-28. In response patterns, residents of single story residences (wood and brick) had scores lower than multiple story (wood and brick) residents and of residents living in houses elevated on pilings. The same relationships existed for the perceptions of danger with one exception: in the later stages the perception of danger for wood, multiple story residents was much lower than that for wood, single story residents. These residential dwelling types should be interpreted as having significance for Galveston only, since, in Galveston, single family dwellings are usually in less vulnerable areas. In contrast, findings in the study of Hurricane Camille indicated that persons living in one story structures were more apt to evacuate (Wilkinson and Ross, 1970).

Family Size

The influence of family size is displayed in Figures 2-29 and 2-30. No statistically significant relationships were discovered in

response patterns, but such was not the case for degree of danger perceived. By disregarding the seven- and eight-person categories because of the small number in each group (six in the seven-person group: five in the eight-person group), there appear to be more extreme perceptions of danger for the three- and four-person family sizes, with less extreme perceptions of danger for family sizes below and above those numbers.

Boat Ownership

The difference made by boat ownership is indicated in Figures 2-31 and 2-32. Those who did not own boats had consistently higher scores for both response patterns and perceptions of danger. For perceptions of danger the difference was statistically significant at the .03 level for the later advisories and bulletins.

Home Ownership

Figures 2-33 and 2-34 show the effect of home ownership. In both response patterns and perceptions of danger, those who owned homes had higher scores in the early stages of hurricane development but lower scores in the later stages. The later stages were, in both categories, statistically significant at the .00 level. This is consistent with the Mississippi State University study which indicated that home owners were less likely to evacuate (Windham et al., 1977). The probable explanation for this is that homeowners would be more inclined to remain to protect their property when a real possibility of damage existed, as would be the case

in the later stages of hurricane development.

Home owners were asked whether or not they had been informed, prior to the purchase of their homes, of the threat to the property in the event of a hurricane. Figures 2-35 and 2-36 show the differences between those who had been informed and those who had not. The response patterns indicate that those who were informed of the hazards had higher response levels in the beginning and ending stages of the hurricane, but lower in the middle. This difference was significant at the .00 level during the later responses. Although the perceptions of danger patterns were not statistically significant, they followed the same trend.

Locus of Control

A locus of control scale was administered to 63 of the interviewees who received the force three hurricane series. The three classifications were internal control, powerful others control, and chance control. The three scales were integrated into one questionnaire. After the 63 questionnaires were completed, they were divided three times. Each time all 63 were first placed into one of the three categories (internal control, powerful others control, or chance control). Within each category they were divided into two groups: high scores and low scores. Low scores indicated a negative relationship to the measured category; high scores indicated a positive relationship.

Figures 2-37 and 2-38 show the influence of high and low internal control scores. Those who felt they controlled their own lives (high scores) had lower response patterns initially, but ended at about the same level. The perceptions of danger paralleled these patterns, but were not as extreme. It is interesting to note that it was more difficult to influence the responses on internally controlled persons. For instance, when a watch, a warning, and an evacuation notice were presented, the gain scores from one advisory to the next were .2, .2, and .1. The same gain scores for low internally controlled persons were .4, .4, and 1.1. The same relationship was reflected in the perceptions of danger (.1, .2, .2, with .3, .1, and 1.4).

The response patterns and perceptions of danger for those who felt their lives were controlled by powerful others (high scores) and those who did not (low scores) are seen in Figures 2-39 and 2-40. Those who felt lives were controlled by powerful others responded in a somewhat similar fashion as did those who felt they were not internally controlled. This relationship is displayed in the response patterns for watch, warning, and evacuation notices. Those who felt their lives were controlled by powerful others had gain scores of .4, .2, and 1.1, while those who felt their lives were not controlled by powerful others had gain scores of .2, .4, and .4. The same relationship can be seen in the perceptions of danger (.3, .1, and 1.2, as contrasted with .2, .2, and .3). The early response patterns had a statistically significant relationship at the .04 level. This appears to be caused

by the reversal of scores for those with powerful others locus of control from a lower response level at the beginning of the hurricane (first few bulletins) to a higher response level at the conclusion of the early development stage (bulletin 13).

Figures 2-41 and 2-42 display the response patterns and perceptions of danger for those who felt chance controlled their lives (high scores) and those who felt it did not (low scores). Those who felt their lives were controlled by chance had lower response patterns and perceptions of danger (significant at the .01 level for the later advisories and bulletins) than those who did not. This makes sense if people who think their lives are controlled by chance feel it makes little difference what they think (perceptions of danger) or what they do (response patterns).

CHAPTER III. STUDY TWO: CONSEQUENCES OF EXPOSURE TO HURRICANE FURY VIA TELEVISION

There is considerable evidence to indiate that expectation of damage is related to evacuation. Wilkerson and Ross (1970) found that for Hurricane Camille, a positive relationship existed between anticipated wind and water damage and the likelihood of evacuation. This relationship also was found to be statistically significant by Baker (1979). Additionally, the Mississippi State University study (Windham et al., 1977) indicated a statistically significant positive relationship between anticipated water damage and wind damage (to roofs and autos) and evacuation. For this study, two experiments were conducted to see if exposure to the destructive fury of a hurricane via television could affect subsequent response patterns, particularly evacuation behavior.

Experiment One

This experiment took place in July 1978. It included 52 female participants, 18 years or older, who were residents of Galveston Island and had been randomly chosen from the Galveston telephone directory. Each participant was paid $10.00. Only females were chosen in order to eliminate the possible confounding effects of male-female differences.

One group of 26 was designated as the control group; the other 26 were classified as the experimental group. The control group was to respond to the 28 advisories and bulletins of the hypothetical Hurricane Karen as described in the first study on "Simulated Hurricane

Variables." The particular version used was a force four with maps which had the bulletins and advisories originating from the National Weather Service in Galveston. Participants were first given instructions for use of the Hurricane Karen booklet and then allowed 45 seconds to respond to one bulletin before being instructed to continue on the next. This process was followed through advisory 22 at which point a film was shown to the control group. Though it was not related to hurricanes, the group was given some indication that it was relevant to the experiment.* Following the film, the remaining advisories and bulletins were completed, beginning with bulletin 23 which was an evacuation warning.

The same procedure was followed for the experimental group, except that rather than seeing the film unrelated to hurricanes, they saw a video tape which was a consolidation of the most destructive scenes from several hurricane films.

The only difference between the control and experimental groups, then, was the film shown. Unfortunately, many participants in both groups took the maximum evacuation response pior to being exposed to the film or the video tape. Hence, the possibility of an increased response was impossible. This, plus some other disqualifying factors, resulted in only five usable responses from participants in the experimental group, and 16 from the control group.

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*The film was relevant to the experiment, but only to ensure that members of the experimental group did not feel they were receiving special attention when they saw a film (i.e., hurricane fury via television) and the control group had not. The conductors of this research did not want special attention to be a factor influencing responses.

Analysis of variance was computed on the responses which each group made to the five bulletins both before and after exposure to the film or video tape. The jump in response patterns for the control group between advisories 22 and 23 was 1.19, while for the experimental group it was 3.6. The average score for advisory 22 for the control group was 3.87; the average of the next five climbed to only 6.72. At the same time, the average score for advisory 22 for the experimental group was 3.4 (lower than the control group), but the average of the next five was 8.52.

Experiment Two

Because of the small number of usable responses obtained in Experiment One, five in the experimental group and 16 in the control, the researchers felt that the influence of hurricane fury should be further tested with a larger number of persons. In May 1979, it was tested again as part of another experiment.

This experiment included a total of 32 persons, 18 years or over, who were randomly chosen from the Galveston telephone directory. Each individual was paid $12.50 for participating.

The control group and the experimental group each consisted of 16 individuals. The control group received instructions and responded to six tape-recorded items of information representing a developing hurricane. They were then shown a film which was unrelated to hurricanes. It was indicated, however, that the film did relate to the experiment (for the same reason stated in Experiment One).

Following this they were given six additional tape-recorded messages. The content of these messages was identical to the six presented before the film was shown, but the wording was changed as much as possible. Different days were used, the hurricane name was changed, and time was referred to as a point in a particular day rather than a number of hours later.

The procedure for the experimental group was identical, except that, rather than viewing the film, they viewed the video tape of hurricane fury.

Table 3-1 contrasts the change in responses after the film or video tape of the control group with the change in responses of the experimental group. For the control group, 6.2 percent of the items of information presented received higher responses after the film than before, 9.4 percent decreased, and 84.4 percent remained the same. The experimental group, which viewed the video tape of hurricane fury and destruction, responded more extremely to 21.9 percent of the items of information, less extremely to 13.5 percent, and remained the same on 64.6 percent. This distribution was statistically significant at less than the .01 level.

Table 3-1

DIFFERENCE IN RESPONSE CHANGES AFTER EXPOSURE TO HURRICANE DESTRUCTION AND FURY

Category	Viewed Film (Control)	Viewed Hurricane Video (Experiments)
Increase	6 (6.2%)	21 (21.9%)
Decrease	9 (9.4%)	13 (13.5%)
Remain the Same	81 (84.4%)	62 (64.6%)

Conclusions

The use of television to display the fury and destructive effects of a hurricane can stimulate people to make more protective responses (such as evacuating) to an actual hurricane. From the signficant response increase displayed in Experiment One, which resulted when the video tape of a hurricane's fury and destructive nature was presented just prior to a bulletin to evacuate, it appears that an effective time and way to further stimulate people to evacuate is to expose them to the destruction of hurricane fury just prior to the evacuation notice.

CHAPTER IV. STUDY THREE: INFLUENCE OF OTHERS, AUTHORITY FIGURES, AND EVENTS ON RESPONSE PATTERNS

Several studies have indicated that statistically significant relationships exist between persons evacuating and their neighbors evacuating (Moore et al., 1963; Wilkinson and Ross, 1970; Baker et al., 1976). However, two factors confound the interpretations and the validity of these results. First, if an entire neighborhood were in a vulnerable area or were ordered (or advised) to evacuate, there would naturally be a high relationship between a person's response and the responses of his neighbors. Second, persons indicating, after such an event, that their decision to evacuate was based on the fact that their neighbors were evacuating might not be correct. Nisbett and Wilson (1977) demonstrated that individuals are typically unaware of the actual events which caused them to respond in certain ways. This does not mean that the individuals did not allude to certain events as the cause, but that their opinions of which events caused the responses were not correct.

In order to guard against these pitfalls and to ensure greater statistical reliability, two experiments were performed for this study to determine the influence of others, authority figures, and events on hurricane response patterns.

The first experiment took place in early May 1979. It tested the influence of strangers, authority figures, and surrounding events. The second experiment took place in late May 1979 and investigated the influence of a spouse or friend.

Experiment One

Twenty-four participants, 18 years or older, were randomly chosen from the Galveston telephone directory. For participating each received $20.

After arriving at Galeston Community College where the experiment was to be conducted, the subjects first filled out questionnaires on basic demographic data and then were instructed how to respond to six items of information regarding a developing hurricane. The ten response options were similar to those utilized in Study One, Chapter II. They ranged from simply "wait for further bulletins" to "evacuate".

This completed the first phase of the experiment, which served as a base from which to measure the next phases. The information presented in phase one did not include outside factors which might influence responses. In the following phases, 19 of the 24 subjects responded to four additional simulated hurricanes in which the variables of social influence (tested by two simulated hurricanes), authority figures, and surrounding events were investigated. Each of the four simulated hurricanes contained the same basic data, but the wording was changed by using different hurricane names, time references, and days of the week. The items of information were tape-recorded as an additional control. The 19 individuals responded to these subsequent simulated hurricanes in three groups of 5 and one group of 4 (5 of the 24 original participants were used as a control group). The order in which the groups responded to these four simulated hurricanes was counter-balanced

to control for sequential effects. Also, the composition of each group was changed for each simulated hurricane to prevent the establishment of set response patterns within groups.

To respond to these four additional hurricanes, each group was directed into a second room where each person sat at one of five designated places, separated by partitions to allow for control of eye contact and other forms of nonverbal communication. Subjects were informed they would again hear a series of six items of hurricane information and were to choose again, from the ten available responses, the response each thought he would make. However, responses now were to be made by flipping one of ten switches on a panel in front of each group member. Each switch corresponded to a different response. Subjects were then allowed to flip a number of switches to verify that they lit up corresponding lights on a master panel which indicated to the experimenter which response the subject had selected. The experimenter could then record the responses made by the subjects. Once the subjects understood this process the master panel was turned away from them (so they could not compare responses) and toward the experimenter. The six items of hurricane information were then presented, and the subjects indicated their responses following each.

To investigate the influence of others, it was necessary to provide subjects with feedback regarding the responses of the other four subjects. This was accomplished by using two different simulated hurricanes. Each subject was shown four other responses to each item of information on a second master panel controlled by the experimenters.

He was told those were the responses of the others in his group. However, this was not so. For one hurricane the responses shown were an average of 1½ steps higher or more extreme than the subject's own responses. For the other hurricane they averaged 1½ steps lower or less extreme. If the other four responses had any influence, then a given subject's response to the six bulletins should be depressed for one hurricane and more extreme for the other.

To investigate the influence of authority figures, the following procedure was used. After the fourth item of information was issued, but before the individuals indicated their responses, they heard a statement that the National Weather Service had issued an advisory urging individuals to take precautionary measures. Following this advisory, subjects made their responses to this fourth item as well as to the fifth and sixth. In like manner, the influence of surrounding events was investigated by stating, following the fourth item, that a number of surrounding industrial plants had closed. Subjects then made their responses to the fourth, fifth and sixth items.

Following the four simulated hurricanes the subjects were administered a scale on which they were to rate the trustworthiness and expertise of the National Weather Service, the mayor, any coastal resident, and local weathercasters. The seven-point scale ranged from the source having no knowledge of hurricanes and the subject putting no trust in what the source said to the source having complete knowledge of hurricanes and the subject putting complete trust in what the source said. This was to provide information regarding the

degree of credibility of the authority figure used in the study. Prior research suggested that the National Weather Service was the most trustworthy.

For the final part of the experiment, all subjects were given a questionnaire soliciting their thoughts about the experiment. Also, any questions they had were answered.

In analyzing the data a statistically significant ($F\ [20, 320] = 1.63$, $P < 0.05$--see Appendix A) three-way interaction effect was found by using analysis of variance (see Appendix A). The factors involved in the three-way interaction were the six items of information, the five simulated hurricanes, and hurricane experience or the lack thereof. Figures 4-1-M and 4-2-M indicate the causes of this significant relationship. In Figure 4-1-M the lines labeled "less" and "more" show that social influence had no significant effect for either increasing or decreasing responses: individuals' responses were higher when others' responses were shown to be higher as well as when they were shown to be lower. *The significant effect seems to be caused by the large increase on item four for surrounding events and a lesser increase for authority figures.* It was before responding to item four that the surrounding events and the authority figures were introduced. A similar pattern can be seen in Figure 4-2-M. However, *in* Figure 4-2-M, *the surrounding events did not yield as much increase as the authority figures.*

This experiment revealed that observing the responses of others did not appear to affect the responses made by an individual. However,

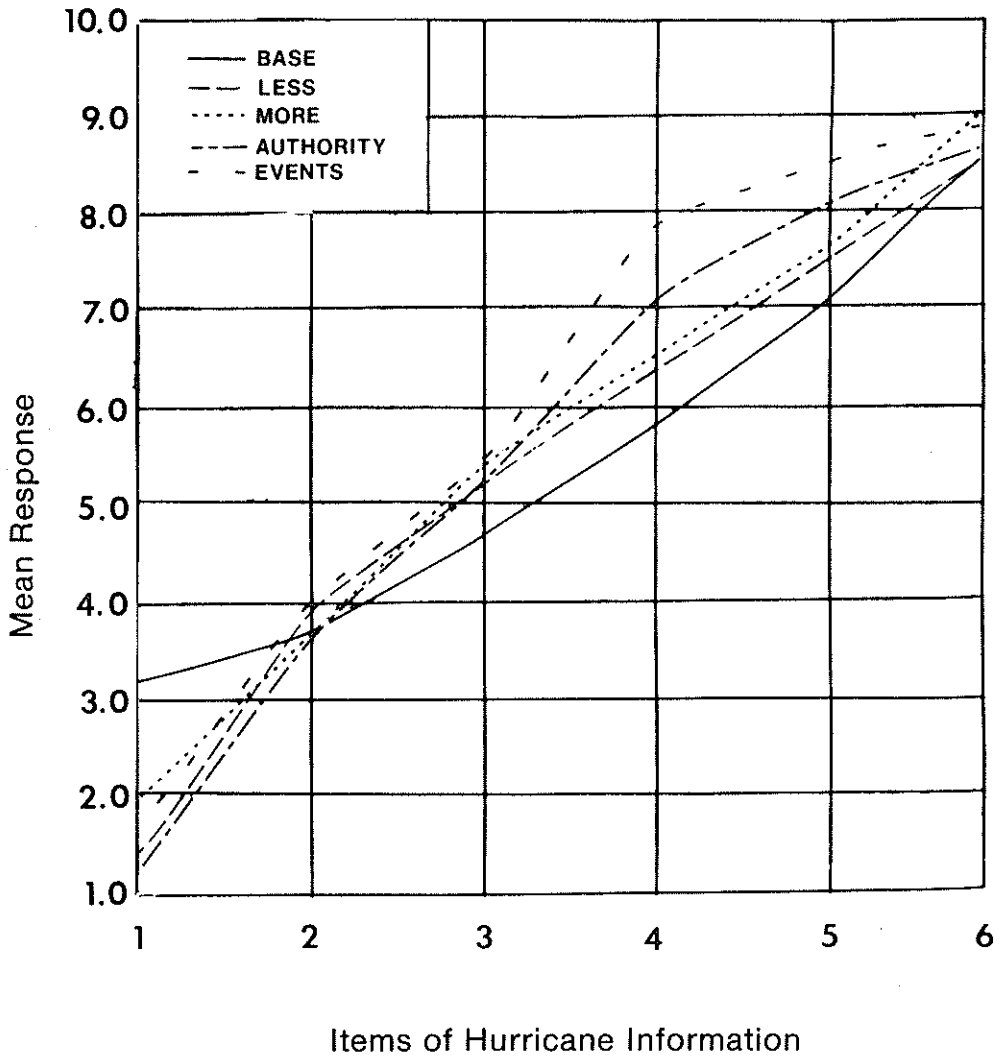

Figure 4-1-M
N = 8
Response to Information by Individuals with Prior Hurricane Experience

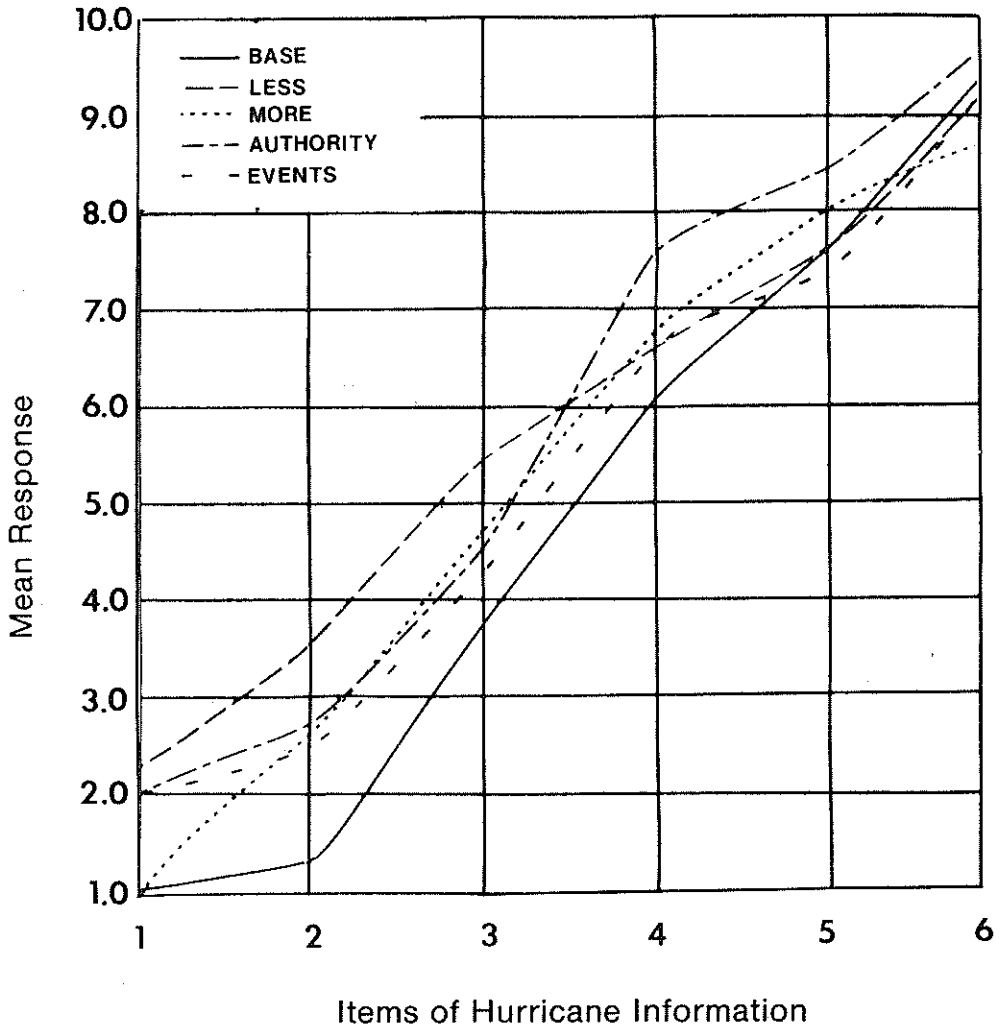

Figure 4-2-M
N = 10
Response to Information by Individuals without Prior Hurricane Experience

hearing an advisory issued by the National Weather Service did produce a more extreme response in those without prior hurricane experience as did informing subjects with prior hurricane experience of certain surrounding events. The fact that surrounding events affected only people with prior hurricane experience would seem logical. These individuals probably became aware of the action taken by surrounding industrial plants in the time the hurricane was developing. After the hurricane passed and in recounting the events that preceded it, these individuals would most likely have included the plant closings. In so doing, a casual connection would have been made which would lead the individuals, on subsequent occasions, to focus on such surrounding events as a significant variable indicating the severity of the impending hurricane. Those without hurricane experience would not have such prior knowledge to fall back on. Therefore, their primary additional source of information would more probably be an authority figure such as the National Weather Service.

Additional support that the National Weather Service was perceived as the most credible source of information was provided by analysis of the trustworthiness and expertise ratings. A combination of these two sets of ratings was interpreted as a single credibility score for each subject's ratings of the mayor, a typical coastal resident, local weathercasters, and the National Weather Service. The credibility ratings were analyzed by analysis of variance. A significant

difference (F [3, 87] = 11.09, $P < .01$) was found among the ratings of the four sources, with the National Weather Service receiving the highest credibility ratings (M = 11.95). The mayor received the lowest ratings (M = 8.86), local weathercasters ranked second (M = 10.77), and the typical coastal resident ranked third (M = 9.63).

The results of Experiment One showed that the responses of others had no impact on individual responses. The researchers felt that such results may have occurred because strangers were used to create the influence. Consequently, the following experiment was designed to test that hypothesis.

Experiment Two

Thirty-four residents from Galveston, Texas, served as subjects for this study. They were selected in the same way as those who participated in Experiment One, with one exception. When contacted, requests were made that both husband and wife participate. If one spouse were not available, participation of a friend was solicited. This procedure resulted in the participation of 16 husband-wife pairs and one friend pair. Each pair received $25.

Subjects were administered the experiment in two consecutive sessions at Galveston Community College, one beginning at 5:30 p.m. and the other at 8:00 p.m. The husband and wife or friend pairs were separated and divided into two groups, each containing an equal number of males and females. Half of the participants (Group A) remained seated while the other half (Group B) went to another room

(the "experimental" room). The subjects in Group A were first given a demographic questionnaire to complete (identical to that described in Experiment One), and were told that the influence a spouse or friend may have on an individual's responses was being investigated, which would involve responding to a simulated hurricane. However, their responses to this simulated hurricane were not to be their own but determined by the responses made by their spouse or friend. In the 5:30 p.m. group subjects were given a card with an "H" or "L" on it. An "H: meant their response was always to be one step higher than that of their spouse or friend; an "L" meant it was to be one step lower.* Group A was told not to discuss their instructions with Group B.

In the meantime, subjects in Group B were given instructions for making responses using the switches on the panels as described in Experiment One. These instructions involved the completion of responses to a simulated hurricane identical to the baseline hurricane information used in Experiment One. Following these instructions and following the completion of Group A's tasks described above, the two groups were brought together. The spouses and friends were

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*Not all the expected participants showed up for the experiment. As a result, only the "higher" influence was used with the 8:00 p.m. group. Then, for the experiment analysis, the "lower" influence of the 5:30 p.m. group was discarded, and the results of the 8:00 p.m. group and of the "higher" influence of the 5:30 p.m. group were combined. This provided a sufficient number of subjects to test for an influence effect, even if it was only in the direction of a more extreme response.

reunited and taken to the experimental room where they responded to six items of information concerning a simulated hurricane. The display panel on which the responses appeared was turned toward the subjects so they could see one another's responses. No partitions existed between the subjects to eliminate any possibility of suspicion that the responses made by the others were bogus. The partners who had been in Group A always responded second, in order to base their responses on those of their spouse or friend according to the directions they had received earlier (that is, one step higher). Because, for analysis purposes, only the "higher" influence was used, the "lower" influence will no longer be referred to. Therefore, if Group A's higher responses had any influence it would be reflected in subsequent responses of the partners who had been in Group B. This, then, would result in a more extreme response pattern for Group B than initially given in their responses to the first simulated hurricane.

Following participation in this second simulated hurricane, subjects filled out post-experimental questionnaires and were informed of the true nature and process of the experiment.

The groups' responses to the six hurricane advisories were then subjected to an analysis of variance test (see Appendix A) and no statistically significant difference was found.

Conclusions

The two experiments in Study Three suggested that advisories issued by authority figures such as the National Weather Service produce a significant impact on individuals in terms of generating a more extreme response. However for individuals with prior hurricane experience, knowledge of the activities of surrounding businesses and organizations is an even more powerful variable in stimulating action. The surprising component identified by these two experiments is that neither the actions of strangers nor the actions of a friend or spouse had any impact on an individual's responses. There seem to be several possible explanations for this. First, it is important to remember that the present study was geared toward the influence of another person's responses only. In an actual disaster situation, one person not only observes the responses of another but generally communicates verbally as well. It may be that verbal communication is the primary influencing factor. The present study investigated only the influence of one person's response on that of another in the absence of any verbal communication.

The failure to find a social influence could also be due to the nature of the task presented to the subjects. Allen (1965), in his review of literature on conformity, identified a number of variables influencing conformity which appear to exist during hurricanes used in this study, since the respondents reported that they attempted to respond as they would to a real hurricane. These variables included the importance of the task, the ambiguity of the task, and the

individual's perceived competence to perform the task. It was found that pressure to conform to someone else decreases as the importance of the task increases, as the ambiguity of the stimulus decreases, and as a person's perceived competence in dealing with the task increases. Responding to hurricanes would be extremely important to individuals inasmuch as hurricanes have such potential for impacting severely on their lives. There would be little chance of ambiguity in that a hurricane either is or is not present, and hence, is or is not a potential threat. Those who had resided on the hurricane-prone Gulf or Atlantic coasts for several years, and had experienced at least one prior hurricane, would have developed some confidence in their ability to respond to an impending hurricane. All these factors operate against one individual's response being influenced by that of another. This does not mean that good persuasive communication could not alter behavior. It only supports this study's findings that, during a hurricane threat, the response of one person has little impact on the response of another.

There is one additional factor which has an impact on an individual's response and could very well operate in a hurricane situation. Darley (1966) found that persons experiencing an enhanced fear level will increase their degree of social conformity. Such a finding suggests that if one could increase the level of fear experienced by individuals when they were threatened by a hurricane, they would then conform more to a social influence. In the present series of studies, it is

doubtful that such a heightened fear level was attained. Similarly, in an actual hurricane situation such a heightened fear level does not appear to exist among all individuals. Windham et al. (1977), revealed that "stayers" perceived the hurricane to be less dangerous than "leavers." Even if a heightened fear level did exist among many individuals, this in no way provides any assurance that the responses individuals would make to cope with this fear are adaptive coping responses. Other investigators (e.g., Schachter, 1959) have revealed that heightened fear levels produce an increased desire for affiliation. One manifestation of this may be the "hurricane party." Individuals experience heightened fear as a function of the hurricane threat and they reduce the fear level by getting together and having a party. Therefore, increasing the fear level of individuals in an effort to have them submit to social influence and engage in more adaptive coping responses may be a tenuous assumption. Some individuals may submit to the social influence while others may seek affiliation and have a hurricane party. Perhaps the best solution to the situation is to convince people that they can satisfy their affiliatlion needs in a Red Cross (or other sponsored) shelter and thereby be engaged in a protective coping response.

CHAPTER V. STUDY FOUR: RESPONSE AS A FUNCTION OF MEDIA PRESENTATION

The purpose of this study was to test certain assumptions regarding the format and content of media presentations of hurricane-related information. The assumptions were:

1. that the use of "saws," which more readily display the vastness of a hurricane, to indicate the position of a hurricane would be more effective than using a "point" on a map. Either a circular-toothed saw representation, or the satellite picture representation of a hurricane (as used in the experiments of this study) both of which indicate the vastness of the hurricane, would be more effective. The "point" used in the experiments of this study was a 6.
2. that non-serious presentations of hurricane information would be less effective than serious presentations.
3. that the introduction of discrepant information would affect response patterns.
4. that a side comment by the announcer regarding the hurricane could have a serious effect on the listeners' responses.

The first two assumptions were tested by simulated television weathercasts and the latter two by simulated radio news and weathercasts.

The experiments took place at Galveston Community College in June 1979. Thirty persons, 18 years or older, randomly chosen from the Galveston telephone directory, participated in the experiment. Each received $10. The experiments took place at 5:30 p.m. and at 7:30 p.m. Ten participated in the 5:30 session and 20 in the 7:30 session. Those in the 7:30 session were divided into two groups of 10.

Television Experiments

Three simulated weathercasts were prepared with the assistance of personnel from Texas A&M University's educational television station (KAMU, Channel 15). Each weathercast consisted of five sequential presentations which covered the development of a hurricane. The information was basically the same in all three series. The first series consisted of a serious presentation of the weather utilizing a point (dot) to indicate the location of the eye of the hurricane. The second series was identical, except the weathercaster used a saw-like satellite representation of the hurricane showing its magnitude. The third series consisted of a presentation of the same basic data (using the "point"), but with the weathercaster indicating that he personally did not think it was a serious hurricane.

Three video tapes were then shown to the participants in groups of 10. Twenty persons saw the serious "point" series and 10 the "saw" series. At the 7:30 session, after one group viewed

the "point" series and heard a radio series (to be discussed later), they were exposed to the non-serious video series.

Subjects were to indicate, by answers to open-ended questions, the actions they would take after each of the five videocasts contained in each series. The nine resulting categories of actions were:

1. Disregard it.
2. Listen for further bulletins.
3. Listen for further bulletins, plus make one protective response.
4. Listen for further bulletins, plus make more than one protective response.
5. Make protective responses and prepare to ride the hurricane out.
6. Make protective responses and prepare to evacuate.
7. Make protective responses and move to higher ground.
8. Make protective responses and evacuate off Galveston Island.
9. Already evacuated off the island and listening for further bulletins.

These nine categories served as a basis for scoring the responses.

To analyze the results, the first response in each series made by each individual was given a score. This provided a base from which the next four responses could be measured. These other four responses were then given "gain" scores; that is, scores showing the amount of increase above the first response. The gain scores

of all participants for each response were then totaled and an average taken. Then individual gain scores were compared to that average to determine whether or not they were higher or lower than the average.

Table 5-1 displays the results of the use of a "point" compared to the use of a "saw" in indicating a hurricane's location. Sixty percent of the "saw" presentation scores were above the average score and 40 percent were below, while the "point" presentation scores were 39 percent above and 61 percent below. This distribution was statistically significant at the .03 level.*

Table 5-2 indicates the average scores for each of the five weathercasts. With the exception of the first weathercast, the "saw" presentation had higher scores.

Table 5-1

COMPARISON OF GAIN SCORES* FOR "POINT" AND "SAW" VIDEO PRESENTATION

CATEGORY	SAW	POINT
Total Number of Increased Scores	24 (60%)	31 (39%)
Total Number of Decreased Scores	16 (40%)	49 (61%)

* $X^2(1) = 4.85$; $P < .03$

* It should be noted that when absolute scores rather than gain scores were used, no statistically significant difference was found. For this reason, in a preliminary analysis of this date no significant difference was noticed.

Table 5-2

COMPARISON OF GAIN SCORES* FOR "POINT"
AND "SAW" VIDEO PRESENTATION

CATEGORY	SAW	POINT
First Weathercast	2.20	2.35
Second Weathercast	3.50	3.35
Third Weathercast	5.50	4.75
Fourth Weathercast	6.60	6.25
Fifth Weathercast	7.60	7.20

Table 5-3 shows a comparison of the gain scores for the non-serious** video presentations. For the non-serious video, 62 percent of the gain scores were above the total average and 38 percent below. For the serious video, 39 percent were higher and 61 percent lower. This was statistically significant at the .01 level. However, to properly interpret the results, the circumstances of this particular experiment must be elaborated. The group viewing the non-serious video, wherein the weathercaster played down the importance of the hurricane, watched with no unusual reaction the first two weathercasts. As could be anticipated, their average scores were lower, according to Table 5-4, than the scores for the serious video presentations.

** Both videos used "point" representation to avoid the influence of additional factors on the responses.

However, beginning with the third presentation, the participants began to laugh at the foolish comments of the weathercaster. Responses to the third, fourth, and fifth weathercasts were significantly higher than those for the serious presentations. The obvious explanation is that they over-responded to compensate for their lack of trust in such a "fruitcake" *** weathercaster.

Table 5-3

COMPARISON OF GAIN SCORES** FOR SERIOUS AND NON-SERIOUS VIDEO REPRESENTATIONS

CATEGORY	NON-SERIOUS	SERIOUS
Total Number of Increased Scores	25 (62%)	31 (39%)
Total Number of Decreased Scores	15 (38%)	49 (61%)

** $X^2(1) = 6.04$; $P < .01$

Conclusions regarding the first two assumptions, as tested by the video presentations, are: first, a positive effect in response patterns can be achieved by using "saw" type presentations which indicate the magnitude of a hurricane more effectively than does a "point" type presentation. Second, it appears that non-serious presentations can have a depressing effect on response patterns. However, if the non-serious presentation destroys trust in the competence of the weather-caster, the listener overcompensates in his response pattern for this

*** This term was applied to the weathercaster by some participants after the tapes were shown.

Table 5-4

COMPARISON OF AVERAGE SCORES FOR SERIOUS AND NON-SERIOUS VIDEO REPRESENTATIONS

CATEGORY	NON-SERIOUS	SERIOUS
First Weathercast	1.80	2.35
Second Weathercast	3.00	3.35
Third Weathercast	5.10	4.75
Fourth Weathercast	7.20	6.25
Fifth Weathercast	8.20	7.20

uncertainty factor. It would seem logical, though, that a listener who loses confidence would (when possible) switch video channels and watch another weathercaster rather than greatly modify his response patterns.

Radio Experiments

Three different series of radio weathercasts were developed. One series was designed for a control group, one to test the effect of an off-hand comment, and one to test the influence of conflicting information. All three series were presented as simulated newscasts using current information about the hurricane combined with a weathercast. The first three in each series were identical. Then, in the fourth weathercast, for the discrepant information series, a conflicting radar report, which indicated a different direction for the hurricane, was introduced. Similarly, in the fourth weathercast for the series testing

an off-hand comment, the weathercaster indicated that he did not think the hurricane was anything to be alarmed about. Other than these two changes, the weathercasts were identical. Each series was presented to 10 different participants.

An analysis of the results indicated no statistically significant data. The similarity in responses for the control, discrepant information, and off-hand comment series is illustrated by the average scores for weathercasts four and five. For the control group the average scores were 6.0 and 7.4; for the discrepant information group they were 6.2 and 7.6; and for the off-hand comment group they were 6.2 and 7.3

The conclusions regarding the last two assumptions based on these simulated radio news weathercasts are that no statistically significant influence on response patterns was created by either discrepant information or by off-hand comments. It should be noted that these experiments do not rule out the possibility of statistically significant relationships existing for response patterns based on other types or amounts of discrepant information or off-hand comments, but that only those investigated here did not detect such relationships.

CHAPTER VI. STUDY FIVE: EFFECT OF FEAR, INFORMATION AND TESTIMONY IN CURRENT HURRICANE MATERIAL

It is often important for both producers and users of hurricane-related material to have some idea of the relative effectiveness of such themes as fear, basic information, and testimony in evoking appropriate hurricane response patterns.

The purpose of this study was to test the effectiveness of these themes in currently available hurricane-related material. In July 1979, 52 persons, 18 years of age or older, randomly chosen from the Galveston telephone directory, participated in this experiment. The participants were divided into four groups of 13. Each group met at a different time (8:00 a.m., 10:00 a.m., 1:15 p.m., and 3:15 p.m.). The participants in the last three groups each received $20; those in the 8:00 a.m. group each received $25 to induce them to come at that time of day.

The participants were first asked to fill out questionnaires requesting general demographic information. Then they completed trial answer sheets regarding the responses they would make to six items of pre-recorded information depicting a developing hurricane. The responses from which they could choose were:

1. I would wait for further bulletins.
2. I would do nothing but *remain inside the house.*
3. I would remain inside the house and *board up the windows.*
4. I would board up the windows, *tie loose objects down and*

collect a supply of food and water.

5. I would board up the windows, tie loose objects down, and collect a supply of food and water and *prepare to ride it out.*
6. I would board up the windows, tie down loose objects and *move a short distance away from the beach area.*
7. I would board up the windows, tie down loose objects and *move to a Red Cross shelter.*
8. I would board up the windows, tie down loose objects and *evacuate.*
9. *I would evacuate off the island immediately.*
10. *I would have already evacuated to a safe area* and am now awaiting further bulletins.

These responses served as pre-test data and a base for comparison of the post-test responses.

Next, the participants received various types of hurricane material (brochures, radio programs and spots, films and TV spots) and were told to rate each item on the following scales:

1) Do you feel the item tested was well done?

Extremely Well Done									Extremely Poorly Done
1	2	3	4	5	6	7	8	9	10

2) Do you feel that Galveston residents would be greatly influenced by this item?

Greatly Influenced									Not Influenced At All
1	2	3	4	5	6	7	8	9	10

3) Do you feel that you were influenced by this item?

Greatly Influenced									Not Influenced At All
1	2	3	4	5	6	7	8	9	10

4) Would this item cause you to increase your hurricane preparedness activities?

Greatly Increase									Not at All
1	2	3	4	5	6	7	8	9	10

The material each group received emphasized a different element being tested. One group received material based on the destructiveness of hurricanes which would potentially produce fear. Items in this category included the short version of the Civil Defense Preparedness film "Lady Called Camille"; three television spots used in the Texas Hurricane Awareness Program "Subsidence," "Beautiful Place," and "Shotgun"; and a booklet published in June 1978 by the Texas Hurricane Awareness Program entitled "Hurricane Awareness." This booklet photographically depicted the destructive effects of hurricanes.

The second group was presented testimonial type material. The items included radio interviews with a hurricane survivor produced by the Texas Hurricane Awareness Program, and a hurricane film produced by the Civil Defense Preparedness Agency entitled "Your Chance to Live."

The third group was given information-oriented material which included NOAA's tape of Dr. Neil Frank entitled "When a Hurricane Threatens: Protecting Life and Property," NOAA's booklet "Storm

Surge and Hurricane Safety," NOAA's film "Hurricane Decision,"* and the Texas Hurricane Awareness Program's brochures "Checklist/Map Brochures" and "Hurricane and Hazard Awareness."

The fourth group received a combination of the three themes. Their materials included, for information, the tape "When a Hurricane Threatens"; for fear, the "Hurricane Awareness" booklet; and for testimony, "Your Chance to Live."

After each group had rated their material, they were given six items of information regarding another developing hypothetical hurricane. These items of information were regarded as a post-test and were identical to those in the pre-test with exception of the hurricane name and the manner in which the passage of time was indicated. The six post-test responses of each participant were compared to his responses to the parallel items of information in the pre-test to determine if the material he had been exposed to influenced his response pattern.

Table 6-1-M compares the change in responses from the pre-tests to the post-tests for each element tested. The least effective element in terms of creating a more extreme response was testimony where 32 percent of the post-test responses decreased and only 8 percent increased. Information also had little effect with 19 percent decreasing and 14 percent increasing their responses. Fear had more than twice as many increased responses as decreased; however,

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*A three minute segment showing destructive effects of hurricanes was omitted.

73 percent were unchanged. *The most effective category reported a combination of all these elements where 44 percent of the responses were changed with 30 percent increased and only 14 percent decreased.*

Table 6-1-M

EFFECT OF TEST ELEMENTS ON RESPONSES*
(By Percent)

Test Elements	DECREASED		REMAINED THE SAME		INCREASED	
	%	Number of Items	%	Number of Items	%	Number of Items
Testimony	32	25	60	47	8	8
Information	19	15	67	52	14	11
Fear	8	6	73	57	19	15
Combination	14	11	56	44	30	23

*$X^2(6)$ P = .0001

Following the post-test, the groups were asked to rate additional hurricane material which had been or would be shown to one of the other groups. The purpose of this was to provide additional data from which to analyze the impact made on the public by each item of material tested. Hence, each hurricane-related item of material was rated by two groups; that is, 26 people. The materials were rated by both groups on the same scale shown earlier in this chapter. To arrive at a composite score for each item of material, a score of 10 was

assigned to a rating of "1", 9 to a "2" rating, and so forth. The 26 scores were then totaled for each of the four questions on the rating sheet. Since the highest a score could be was 260 (26 x 10), the totaled scores were divided by 260 to show what percentage the actual rating was of the total possible. The results are displayed in Table 6-2.

Conclusions

The most effective method for maximizing increased safety response patterns is a combination of hurricane related material which includes the themes of testimony, information and fear. When each theme is used independently, then the most effective is fear, followed by information, with testimony being the least effective.

Table 6-2

HURRICANE AWARENESS MATERIAL EVALUATION
(by percentage favoring each statement)

	ITEM WAS DONE WELL	GALVESTON RESIDENTS WOULD BE GREATLY INFLUENCED BY THIS ITEM?	YOU WERE INFLUENCED BY THIS ITEM	THIS ITEM WOULD CAUSE YOU TO INCREASE YOUR HURRICANE PREPAREDNESS ACTIVITIES
FILMS				
Hurricane Decision	74	70	73	72
Lady Called Camille (short version)	85	82	85	84
Your Chance to Live (the hurricane one)	82	79	76	70
60 SEC. TEXAS AWARENESS TV SPOTS				
Subsidence	76	72	70	67
Beautiful Place	76	64	67	63
Shotgun	75	68	68	59
RADIO SPOTS				
Texas Awareness on Testimony	66	57	56	57
When a Hurricane Threatens	80	67	68	68
PRINTED MATERIAL				
Storm Surge and Hurricane Safety	88	79	78	78
Texas Related: -Hurricane and Hazard Awareness	84	70	77	67
-Awareness Checklist/Map Brochure	94	82	84	81
-Hurricane Awareness Booklet	86	77	77	73

CHAPTER VII: HURRICANE RESPONSE MODEL

The hurricane response model developed here utilizes the information from the preceding material. This model (see Figure 7-1) enumerates items, listed under "Pre-Warning Message Enhancement," which can be employed to enhance warning messages issued through hurricane awareness programs. The items are divided into those which have possible national implications (N) and those which are specific to Galveston (G). The model also discusses ways in which the media can enhance warning messages under threat of a hurricane. These items, too, are divided into those which have possible national implications (N) and those which are specific to Galveston (G). This model is not to be considered as inclusive, but rather as a systematic approach to hurricane warning message enhancement which incorporates only those elements studied for which there has been found some statistical or similar justification.* The end goal is to enhance warning messages to the point that they maximize safety responses.

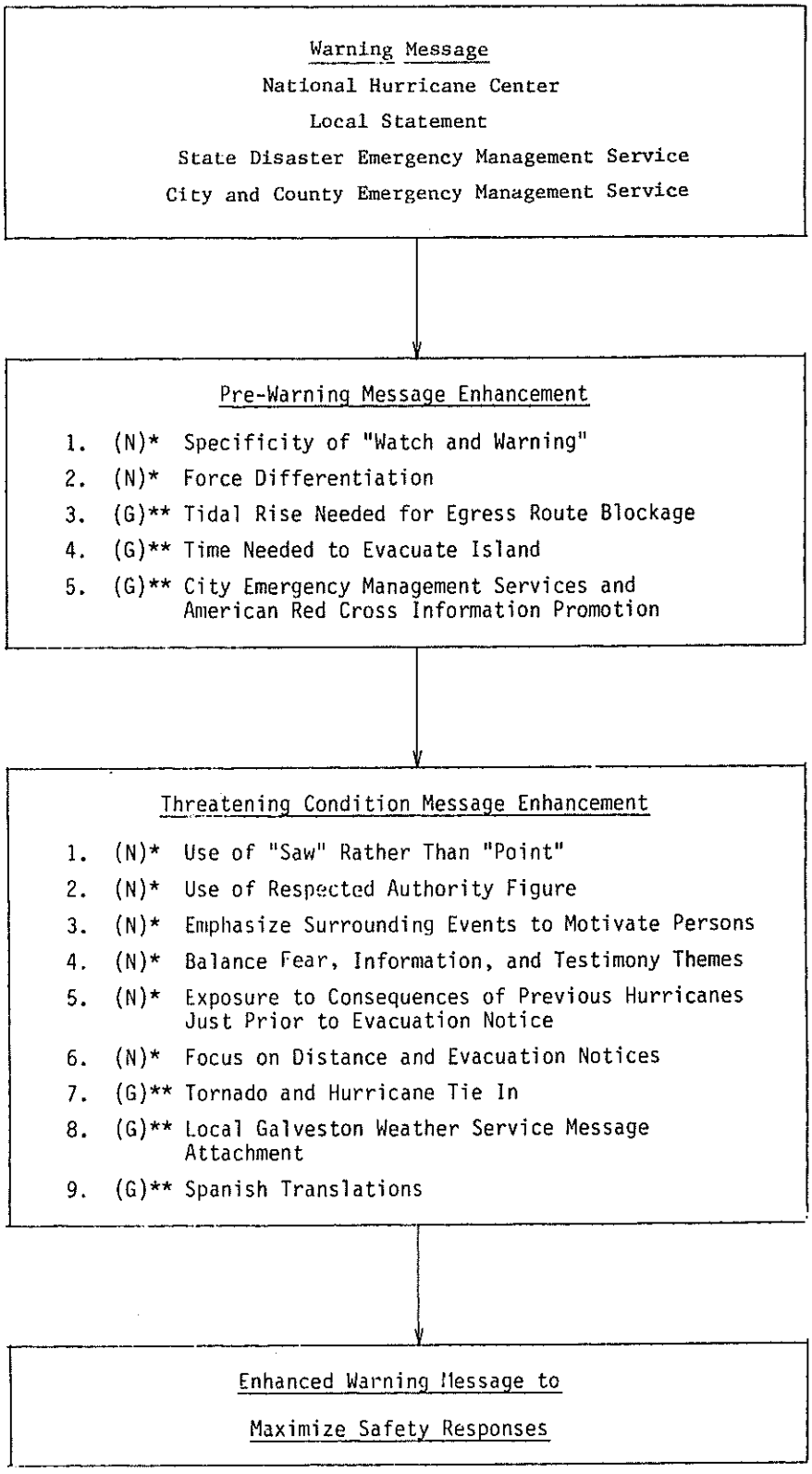
Warning Messages

Warning messages initially originate at the National Hurricane Center in Miami, Florida. Then, in conjunction with the local National Weather Service offices and the city and county emergency disaster management personnel, and in concert with state emergency disaster management agencies, the messages are given area specificity. However, this study does not address the interaction of the origin of warning

*For additional element - see Chapter I.

Figure 7-1

HURRICANE RESPONSE MODEL



*N = Possible National Application

**G = Galveston Application

messages, but merely ways the messages can be enhanced toward stimulation of maximized safety responses.

Pre-Warning Message Enhancement

This model discusses five information-related items which should be stressed by hurricane awareness programs in program materials prepared and distributed prior to a hurricane threat. The five items include two with possible national application and three which are specific to Galveston:

1. (N) The public needs to become more aware of what specific actions they should take during a "watch" and a "warning." The response patterns to the issuance of a "watch" and "warning" during the simulated hurricane were inadequate and reflected a lack of understanding by the public of specific actions to be taken under such circumstances. In Table 2-9-M there were no statistically significant differences in response patterns or in perceptions of danger for the issuance of a "watch" or "warning."
2. (N) People tend to perceive all hurricanes beyond force one as "bad" (see page 26 or Figure 2-3-M). This lack of distinction beyond force one could impair sound judgments of adequate perceptions of danger and of correct responses when hurricanes of force two, three, four, or five are threatening. People should receive information on the

damage that varying wind speeds and the accompanying storm surge can produce.

3. (G) In Galveston, people need to be informed about the amount of tidal rise required to block island evacuation. Five to six feet is the generally accepted figure. The lack of public knowledge in this area is illustrated in Table 2-6-M. Only 23.3 percent of those interviewed believed a tidal rise of five or less feet could block egress routes from the island. Others felt a higher tidal rise was required (six feet or above). Nearly 29 percent had no idea.

4. (G) People in Galveston should also be informed of the time it takes to evacuate the island. Results of this study indicate that nearly 30 percent of Galveston's residents believed an evacuation of the entire population could be accomplished in only six hours. Over 25 percent had no idea (See Table 2-7-M).

5. (G) Galveston residents need information on the function of the city's emergency management (Civil Defense) as well as the American Red Cross. When interviewees were asked where they would go for additional hurricane information (see Table 2-4-M), only 3.6 percent specified the Civil Defense authorities and only 1.4 percent the American Red Cross. This indicates an inadequate perception of the role of these two organizations, which became more apparent when interviewees were asked to state their choice of the most credible source in case of conflicting information.

Only 5.9 percent selected the local Civil Defense and 2.2 percent the American Red Cross (See Table 2-5-M).

Threatening Condition Message Enhancement

When a threatening condition exists, there are several ways whereby the mass media can enhance a warning message's ability to elicit maximized safety responses. Nine such ways have been identified. Six are national in scope and three are specific to Galveston:

1. (N) When the position of a hurricane is indicated by television weathercasters, a "saw" (or satellite picture) which portrays the storm's magnitude will be more effective in stimulating maximum safety responses than use of a "point" (dot) or other type of symbol not indicating magnitude (see page 59).
2. (N) Persons without hurricane experience are best motivated by a respected authority figure (see page 46). In this study it was found that the National Weather Service had a high degree of credibility (see page 49). There is no reason to believe this high credibility does not exist elsewhere.
3. (N) Persons with hurricane experience are best motivated to maximize their safety responses when notified of surrounding events which they have, on previous occasions, identified as indicators of the

seriousness of a hurricane threat (see page 46).

These events may be anything from plant closings to railroad box car movement. In Galveston, 71.2 percent of the persons interviewed had had hurricane experience. The media must be aware of the events that are important to such persons and report them as they occur.

4. (N) Hurricane warnings and evacuation notices are more effective in stimulating maximum safety responses when the media emphasis has been balanced with (1) informative facts, (2) testimony, and (3) fear-producing elements (see page 68). When time does not allow more than one of these three influences to be used, fear is the most effective (see Table 6-1-M). Both radio and television stations should have such materials on hand or know where to obtain them on short notice. Further, they should have plans formulated prior to hurricane threats on how to best use these materials.

5. (N) Television exposure to the destructive consequences of hurricanes also helps stimulate maximized safety responses (see page 41).

as does the expectation of hurricane caused damage (Wilkerson and Ross, 1970; Windham, et al., 1977). When such destruction is shown after a warning is issued, it helps maximize later responses to evacuation

orders and/or recommendations (see page 41).

6. (N) In this study it was found that the distance of a hurricane from land and evacuation notices were the two most effective factors for stimulating safety response patterns (see page 22). Consequently, the media should emphasize these in its hurricane messages.
7. (G) In addition to using films on television which depict the possible damage inflicted by hurricanes, the media should establish the connection between hurricanes and tornadoes. In Galveston 72 percent of the residents indicated they feared hurricane spawned tornadoes more than the hurricanes themselves.
8. (G) Nearly 89 percent of the residents of Galveston Island indicated that, in cases of conflicting information, they would believe the local National Weather Service.

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APPENDIX A

DEFINITIONS OF STATISTICAL TERMS

APPENDIX A

DEFINITIONS OF STATISTICAL TERMS

Chi Square or x^2

This is a statistical test used to determine if two or more groups of individuals respond with different frequencies to a given item. For example, if you wanted to know if significantly more males vs. females evacuated upon hearing an advisory to do so, you would employ a Chi Square analysis to make this assessment.

Degrees of Freedom

Degrees of Freedom are necessary for the determination of the significance of a given statistical test. The term means the number of variables that are free to vary given the number of restrictions imposed upon the data.

F-Test or Analysis of Variance (see T-Test)

The F-Test or Analysis of Variance is a statistical test whose purpose is identical to that of the T-Test. The difference between the T-Test and F-Test or Analysis of Variance is that the T-Test can be used only when one wants to know if the average score of two groups of people differ significantly. There are times when one must determine if the average scores of more than two groups of subjects differ significantly. To accomplish this one must use Analysis of Variance or the F-Test.

Level of Significance

When employing statistical tests such as Chi Square, we are attempting to increase the chances of our final decision being a correct decision. However, statistical tests result in only probability statements. Statistical tests tell us only the probability of one group being higher, larger, or responding more frequently than another group. At no time is there a point at which you can say, with 100% certainty, that one group is better than, or greater than, another group. Consequently it is a judgmental matter as to when you say that one group is "really" better than or different from another group. To minimize the chance of being wrong, scientists use statistical tests to assess the probability of one group being different from another group by chance alone. When two or more groups of people respond so differently that there is only a 5% (.05) probability of the observed difference being due to chance, we say the two groups of people "really" differ. This is because we now have a 95% probability of being correct in saying that they really differ and only a 5% chance of being wrong in such a statement. When we do this we say we are operating at the .05 level of significance. When we are not comfortable with this significance level we would move it up to the 1% (.01) level. This would mean that there was only a 1% chance of our being wrong. Consequently, levels of significance indicate your chance of being correct or incorrect in stating that two groups of individuals differ in some way.

Scheffe's Test

Scheffe's Test is a statistical test used for comparing the means of a number of groups that have been shown to be significantly different by analysis of variance.

T-Test

The T-Test is a statistical test that is used to determine if the average score made by one group of people differs significantly from the average score of another group of people.

APPENDIX B

HURRICANE DISASTER-POTENTIAL SCALE

APPENDIX B

The following excerpt is reprinted from NOAA Magazine, Volume 4, Number 3, July 1974.

HURRICANE DISASTER-POTENTIAL SCALE:*

The hurricane disaster-potential scale is an experimental effort by the National Weather Service to give public safety officials a continuing assessment of the potential for wind and storm-surge damage from a hurricane after it reaches a point where it could be a threat to their coastal populations.

Scale numbers are made available to public-safety officials when a hurricane is within 72 hours of landfall.

Scale numbers range from 1 to 5--with Scale No. 1 having at least the threshold windspeed of a hurricane of 74 miles per hour, or a storm surge 4 to 5 feet above normal water level--and Scale No. 5 having a windspeed of 155 miles per hour or more, or a storm surge more than 18 feet above normal.

The Weather Service emphasizes that the disaster-potential numbers are not forecasts, but will be based on observed conditions at a given time in a hurricane's lifespan. They represent an estimate of what the storm would do to a coastal area if it were to strike without change in destructive power. Scale assessments will be revised regularly as new observations are made, and public-safety organizations will be continually advised of new estimates

*Developed by Herbert Saffir, Dade County Consulting Engineer, and Dr. Robert Simpson, former National Hurricane Center Director.

of the hurricane's disaster potential.

The Disaster-Potential Scale gives probable property damage and evacuation recommendations as follows:

Scale No. 1: Winds of 74 to 95 miles per hour. Damage primarily to shrubbery, trees, foliage and unanchored mobile homes. No real damage to other structures. Some damage to poorly constructed signs. Or: Storm surge 4 to 5 feet above normal. Low-lying coastal roads inundated, minor pier damage, some small craft in exposed anchorages torn from moorings.

Scale No. 2: Winds of 96 to 110 miles per hour. Considerable damage to shrubbery and tree foliage, some trees blown down. Major damage to exposed mobile homes. Extensive damage to poorly constructed signs. Some damage to roofing materials of buildings; some window and door damage. No major damage to buildings. Or: storm surge 6 to 8 feet above normal. Coastal roads and low-lying escape routes inland cut by rising water 2 to 4 hours before arrival of hurricane center. Considerable damage to piers. Marinas flooded. Small craft in unprotected anchorages torn from moorings. Evacuation of some shoreline residences and low-lying island areas required.

Scale No. 3: Winds of 111 to 130 miles per hour. Foliage torn from trees, large trees blown down. Practically all poor constructed signs blown down. Some damage to roofing materials of buildings; some window and door damage. Some structural damage to small buildings. Mobile homes destroyed. Or: storm surge 9 to 12 feet above

normal. Serious flooding at coast and many smaller structures near coast destroyed; larger structures near coast damaged by battering waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane centers arrives. Flat terrain 5 feet or less above sea level flooded inland 8 miles or more. Evacuation of low-lying residences within several blocks of shoreline possibly required.

Scale No. 4: Winds of 131 to 155 miles per hour. Shrubs and trees blown down, all signs down. Extensive damage to roofing materials, windows and doors. Complete destruction of mobile homes. Or: storm surge 13 to 18 feet above normal. Flat terrain 10 feet or less above sea level flooded inland as far as 6 miles. Major damage to lower floors of structures near shore due to flooding and battering by waves and floating debris. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane centers arrives. Major erosion of beaches. Massive evacuation of all residences within 500 yards of shore possibly required, and of single-story residences on low ground within 2 miles of shore.

Scale No. 5: Winds greater than 155 miles per hour. Shrubs and trees blown down, considerable damage to roofs of buildings; all signs down. Very severe and extensive damage to windows and doors. Complete failure of roofs on many residences and industrial buildings. Extensive shattering of glass in windows and doors. Some complete building failures. Small buildings overturned or blown away. Complete destruction

of mobile homes. Or: storm surge greater than 18 feet above normal. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water 3 to 5 hours before hurricane center arrives. Massive evacuation of residential areas on low ground within 5 to 10 miles of shore possibly required.

Definition of the Scale

Category	Central Pressure (millibars)	Winds (mph)	Surge (ft)	Example
1	> 980	74-95	4-5	Agnes 1972(Fla. coast)
2	965-979	96-110	6-8	Cleo 1964
3	945-964	111-130	9-12	Betsy 1965
4	920-944	131-155	13-18	Donna 1960 Fla., Carla 1961 Tex.
5	< 920	> 155	> 18	1935 Storm on Fla. Keys

APPENDIX C

SURVEY QUESTIONNAIRES

HURRICANE RESPONSE QUESTIONNAIRE WITH TABULATED RESULTS

TELEPHONE SECTION

Name (confirm): _____

Address (confirm): _____

Mr. or Mrs. _____ I am _____ from Galveston Community College. We are conducting a survey on hurricane information. This survey is being conducted in cooperation with the National Hurricane Center in Miami, Florida, the National Weather Service, the Texas Coastal and Marine Council, and the Galveston Marine Affairs Council. The Galveston Marine Affairs Council represents the City of Galveston. Would you be willing to answer a few questions for us? (If no, indicate you understand and thank them anyway).

1. "Have you ever experienced a hurricane?" Yes 269 No 109.
   If yes, ask "What was the name of the most severe hurricane?" Name Carla had 229. If they do not remember, ask "Do you remember what year it took place?" Year _____. "Where were you living at the time?" Place (if Galveston, address) _____.
   Did you evacuate?" Yes 126 No 132 . If the place was Galveston, ask "Did you leave Galveston Island" Yes 40 No 122 .
2. "Approximately how many years have you lived in Galveston?" 217 over 10 yrs. If less than ten years, ask "What city

did you live in before coming to Galveston?" 121 less than 10 yrs: Coastal-39, Inland-58, Out of Country-7

3. "Are there any elderly or sick persons in your household whom would be difficult to evacuate?" Yes 40 No 340 .

4. "Would your employment or other activities possibly require you or a member of your family to remain on the island when others were evacuating?" Yes 96 No 277 .

5. "If you were to evacuate because of a severe hurricane, would you evacuate off the island?" (If they would not evacuate at all, go to question six.) Yes 244 No 119 . If no, ask "Where would you go?" Place 8 to civil defense or Red Cross shelter; 17 to other locations. If yes, ask "Where would you go?" 39 - out of coastal area 37 - coastal area. "Would you take your car?" Yes 47 No 7 . "Would you be leaving any cars behind?" Yes 16 No 27 . If yes, ask "How many?" 14 one; 1 two. "Do you think you or any member of your family would try to remain in order to protect your property?" Yes 27 No 53 . (This question was asked only in the early questionnaires.)

6. "How many hours do you think it would take to evacuate Galveston Island?" 96 blanks - see hours and frequency hours

7. "How high do you think the tide would have to get in order to block the evacuation routes off the island?" 110 blanks - see tide and frequency .

HOURS	FREQUENCY
0	96
1	36
2	27
3	16
4	7
5	8
6	16
7	5
8	10
9	2
10	4
11	2
12	> 29
13	3
14	2
15	4
16	2
17	1
18	2
19	1
20	3
24	> 56
30	1
36	16
42	1
48	> 24
60	2
68	1
72	3
82	1
84	1

TIDE	FREQUENCY
0	110
2	7
3	8
4	19
5	55
6	43
7	32
8	15
9	11
10	24
11	6
12	11
13	4
14	4
15	15
17	1
18	3
19	1
20	7
30	1
32	1
62	1
80	1
81	1

INTERVIEW SECTION

After you have introduced yourself and both you and your interviewee are sitting comfortably, indicate "As we go through these items, if there are any you do not want to answer, feel free to let me know. In other words, we want you to know you are under no obligation to answer all of them. All your answers will be confidential."

1. "Did you obtain a copy of this 'Hurricane Survival Checklist' and 'Tracking Map'?" (Show them your copy.) Yes 91 No 269. If no, indicate you will leave that copy when you are finished. If yes, "Do you still have it?" Yes 52 No 32. "Did you read it?" Yes 54 No 10. "How did you obtain it?" Mail 5, Employer or Friend 23, Local Store 19, Civil Defense 1, TV or Radio Advertisement 6, Weather Service 1, Other 9.

2. "Do you remember hearing any 'Hurricane Awareness' radio spots?" Yes 259 No 119.

4. "If you needed additional hurricane information, how would you obtain that information?" Weather Service 152, Radio 71, TV 57, Newspaper 17, Police, Sheriff or Coast Guard 14, Civil Defense 13, Red Cross 5, Other 33.

5. "What is the total number of persons in your family including yourself?" 1 - 71, 2 - 102, 3 - 74, 4 - 63, 5 - 32, 6 - 19, 6+ - 19

6. "Do you own your own home?" Yes 237 No 140. If yes, ask "Were you informed of the potential hurricane hazards when you

bought your home?" Yes 129 No 106. If no, ask "If you had known, do you think that you would have altered your decision?" Yes 16 No 90.

7. "Do you own a boat?" Yes 49 No 290. If yes, ask "Is the boat kept in the water?" Yes 9 No 30. "Would you take the boat with you if you evacuated?" Yes 7 No 30. "How big is your boat?" 17'-20'=12, 10'-16'=16, 20'+=7

8. "What type of preparation do you feel should be made during a hurricane watch?" See end of questionnaire

9. "If there were conflicting reports on a hurricane, which of the following sources would you most likely believe (put a number "1" in front of that item)?" "If that source were not available, then which would you choose (put a number "2" in front of that item)?"

1st	2nd		1st	2nd	
68	75	Television	22	88	Local Civil Defense
39	111	Radio	8	30	Red Cross
2	9	Newspaper	234	41	National Weather Service

If the answer is the National Weather Service, ask "Which source of National Weather Service information would you most likely accept?"

31 National Hurricane Center in Miami

238 The Galveston Office of the National Weather Service

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10. "If a hurricane would be approaching Galveston Island and the only item of information was the wind speed on Galveston Island, at what point would you consider yourself in danger (put a letter 'D;)?" "At what point would you consider evacuating (put a letter 'E')?"

Danger	Evacuate		Danger	Evacuate	
11	6	0-24 MPH	123	128	50-74 MPH
61	35	25-49 MPH	157	147	75 plus MPH

11. "Now assume the one item of information was the number of feet the water was above the normal tide on Galveston Island. At what point would you consider yourself in danger (put a letter 'D')?" "At what point would you consider evacuating (put a letter 'E')?"

D	E		D	E		D	E		D	E	
11	11	1,2 ft.	110	110	5,6 ft.	42	31	9,10 ft.	33	27	15 plus ft.
67	52	3,4 ft.	56	62	7,8 ft.	37	35	10,14 ft.			

12. "Now assume the one item of information you were given was the number of hours before the hurricane force winds and water would hit Galveston. At what point would you consider yourself in danger (put a letter 'D')?" "At what point would you consider evacuating (put a letter 'E')?"

D	E		D	E	
115	103	24 hours	92	103	12 hours
48	50	18 hours	99	79	6 hours

13. "Without the seawall, would you live in Galveston?" Yes 146 No 214.

14. "Do you fear tornadoes spawned by hurricanes more than the hurricane itself?" Yes 263 No 100.

15. "Would you estimate that your total family income would fall above or below $13,000?" Above 203 Below 142.

16. "Would the highest grade you completed in school be more or less than 12th grade?" More 251 Less 124.

Next give your interviewee the yellow booklet along with the response sheet. The set letter that each interviewee is to receive will be indicated on your lists. Put the set letter on the response sheet. Indicate the note on the front, go over the definition of terms, and read over the types of action they can take. Go over the three practice examples.

After the interviewee has finished and returned the booklet and the response sheet, ask, "Did you feel when you were giving information on your responses to Hurricane Karen that this could have been a real hurricane?" Yes 335 No 19 . If they answer "no," ask, "Why?"

7 said it changed directions too many times.

The Locus of Control Scale will only be administered to 75 out of the 400 interviewees. Those who have randomly been chosen to receive it will be indicated on your cards. If the words "Locus of Control"

appear on your card, then present them with the Locus of Control Scale and ask them to fill it out. Indicate again that their answers will be confidential.

Question 8

130	I would board up the windows, tie down loose objects, collect a supply of food and water, and wait for further bulletins.
23	I would evacuate immediately.
15	I would wait for further bulletins.
14	I would board up the windows and remain inside the house.
5	I would board up the windows, tie down loose objects, and move a short distance away from the beach area.
4	I would board up the windows, tie down loose objects, collect a supply of food and water, and prepare to ride it out.
2	I would do nothing but remain inside the house.
1	I would board up the windows, tie down loose objects, and move to a Civil Defense or Red Cross shelter.
151	Other type of response: _____

_____

LOCUS OF CONTROL SCALE

Following is a series of attitude statements. Each represents a commonly held opinion, and there are no right or wrong answers. You will probably disagree with some items and agree with others. We are interested in the extent to which you agree or disagree with such matters of opinion.

Read each statement carefully. Then indicate the extent to which you agree or disagree by circling the number in front of each statement. The numbers and their meaning are indicated below:

If you agree strongly	- circle +3	If you disagree slightly	- circle -1
If you agree somewhat	- circle +2	If you disagree somewhat	- circle -2
If you agree slightly	- circle +1	If you disagree strongly	- circle -3

First impressions are usually best in such matters. Read each statement, decide if you agree or disagree and the strength of your opinion, and then circle the appropriate number in front of the statement. *Give your opinion on every statement.*

If you find that the numbers to be used in answering do not adequately indicate your own opinion, use the one which is *closest* to the way you feel. Your responses will be kept confidential.

Agree			Disagree			
+3	+2	+1	-1	-2	-3	1. Whether or not I get to be a leader depends mostly on my ability.
+3	+2	+1	-1	-2	-3	2. To a great extent my life is controlled by accidental happenings.
+3	+2	+1	-1	-2	-3	3. People like myself feel that the people in power mostly determine what will happen in the lives of people like me.
+3	+2	+1	-1	-2	-3	4. Whether or not I get into a car accident depends mostly on how good a driver I am.
+3	+2	+1	-1	-2	-3	5. When I make plans, I am almost certain to make them work.
+3	+2	+1	-1	-2	-3	6. Often there is no chance of protecting personal interests from bad luck happenings.
+3	+2	+1	-1	-2	-3	7. When I get what I want, it's usually because I'm lucky.
+3	+2	+1	-1	-2	-3	8. Although I might have good ability, I will not be given leadership responsibility without appealing to those in positions of power.
+3	+2	+1	-1	-2	-3	9. How many friends I have depends on how nice a person I am.
+3	+2	+1	-1	-2	-3	10. I have often found that what is going to happen will happen.
+3	+2	+1	-1	-2	-3	11. My life is chiefly controlled by powerful others.
+3	+2	+1	-1	-2	-3	12. Whether or not I get into a car accident is mostly a matter of luck.
+3	+2	+1	-1	-2	-3	13. Persons like myself have very little chance of protecting our personal interests when they conflict with those of strong pressure groups.
+3	+2	+1	-1	-2	-3	14. It's not always wise for me to plan too far ahead because many things turn out to be a matter of good or bad fortune.
+3	+2	+1	-1	-2	-3	15. Getting what I want requires pleasing those people above me.
+3	+2	+1	-1	-2	-3	16. Whether or not I get to be a leader depends on whether I'm lucky enough to be in the right place at the right time.
+3	+2	+1	-1	-2	-3	17. If important people were to decide they didn't like me, I probably wouldn't make many friends.
+3	+2	+1	-1	-2	-3	18. I can pretty much determine what will happen in my life.
+3	+2	+1	-1	-2	-3	19. I am usually able to protect my personal interests.
+3	+2	+1	-1	-2	-3	20. Whether or not I get into a car accident depends mostly on the other driver.
+3	+2	+1	-1	-2	-3	21. When I get what I want, it's usually because I worked hard for it.
+3	+2	+1	-1	-2	-3	22. In order to have my plans work, I make sure that they fit in with the desires of people who have power over me.
+3	+2	+1	-1	-2	-3	23. My life is determined by my own actions.
+3	+2	+1	-1	-2	-3	24. It's chiefly a matter of fate whether or not I have a few friends or many friends.

OBSERVATION SECTION:

Check category best describing their place of residence:

92	Wood single story	55	Brick single story
55	Wood single story elevated on pilings	51	Brick multiple story
85	Wood multiple story	2	Mobile home
		37	Other, please specify _____

Race: Latin 34, Anglo 245, Black 78, Other 15

Sex: Male 165, Female 204

Estimate Age of Interviewee:

10-19	7
29-29	79
30-39	81
40-49	66
50-59	75
60	70

APPENDIX D

FIGURES 2-1 THROUGH 2-42

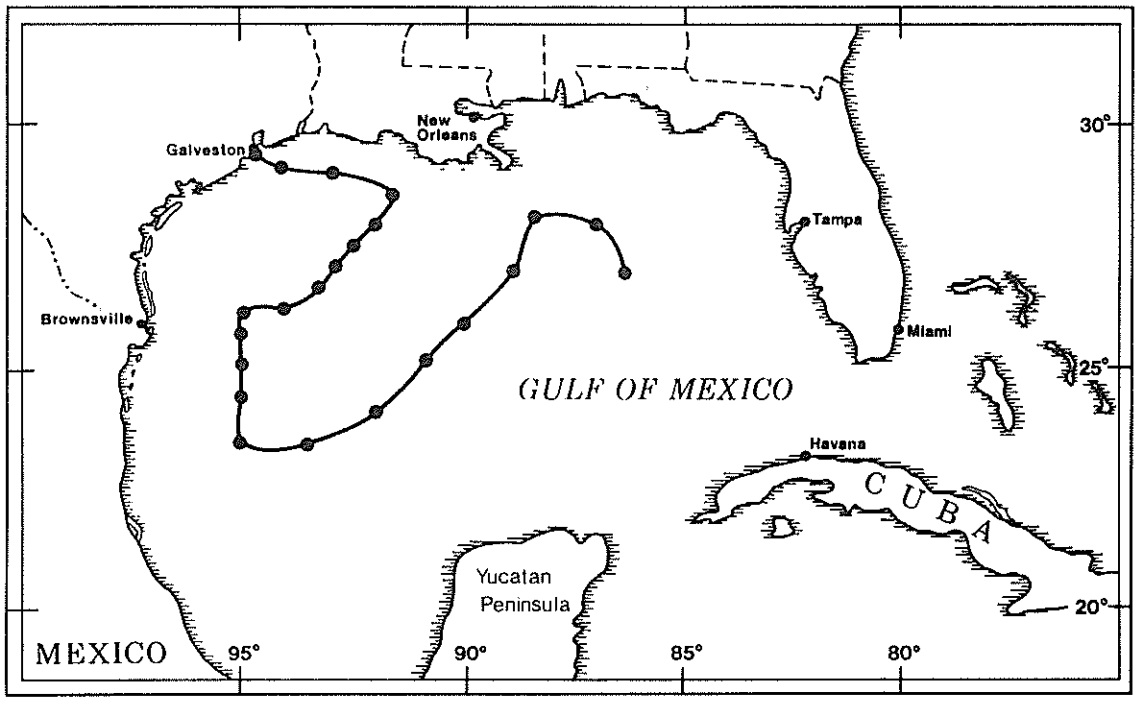

Figure 2-1
Path of Simulated Hurricane

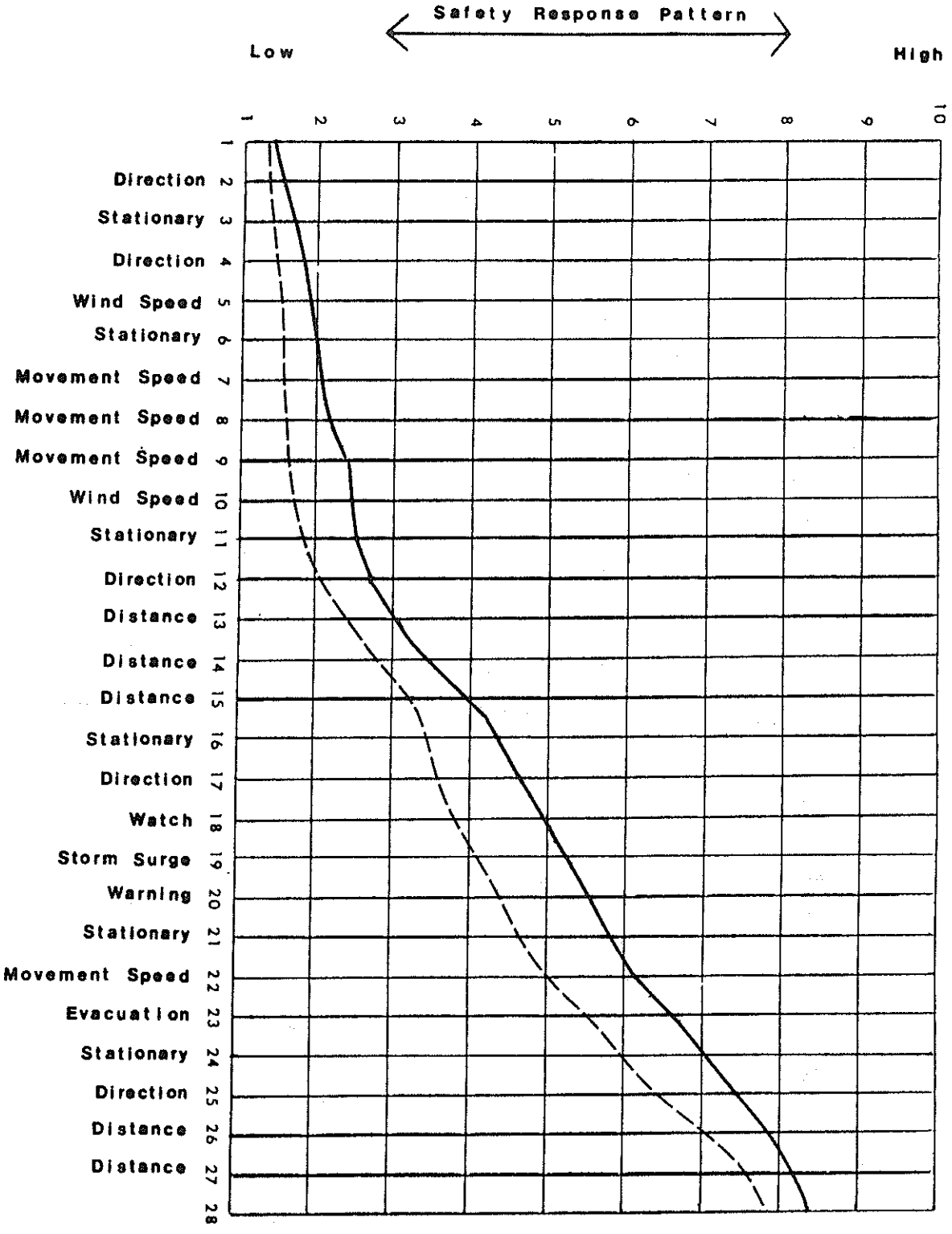

Figure 2-2
Relationship Between Response Patterns and
Perception of Danger for all Variables Tested
N = 381

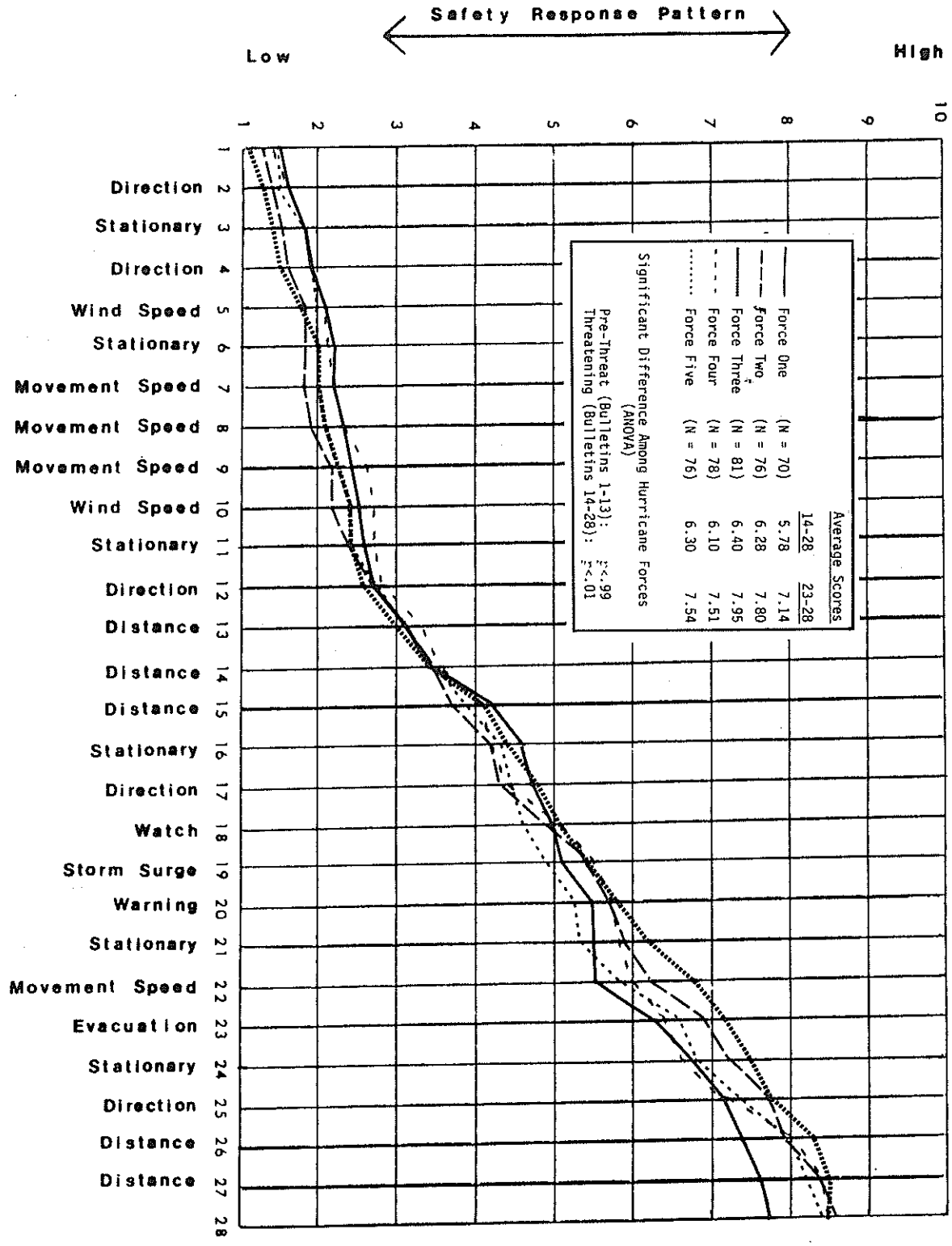

Figure 2-3-M
Influence of Hurricane Force on Response Patterns

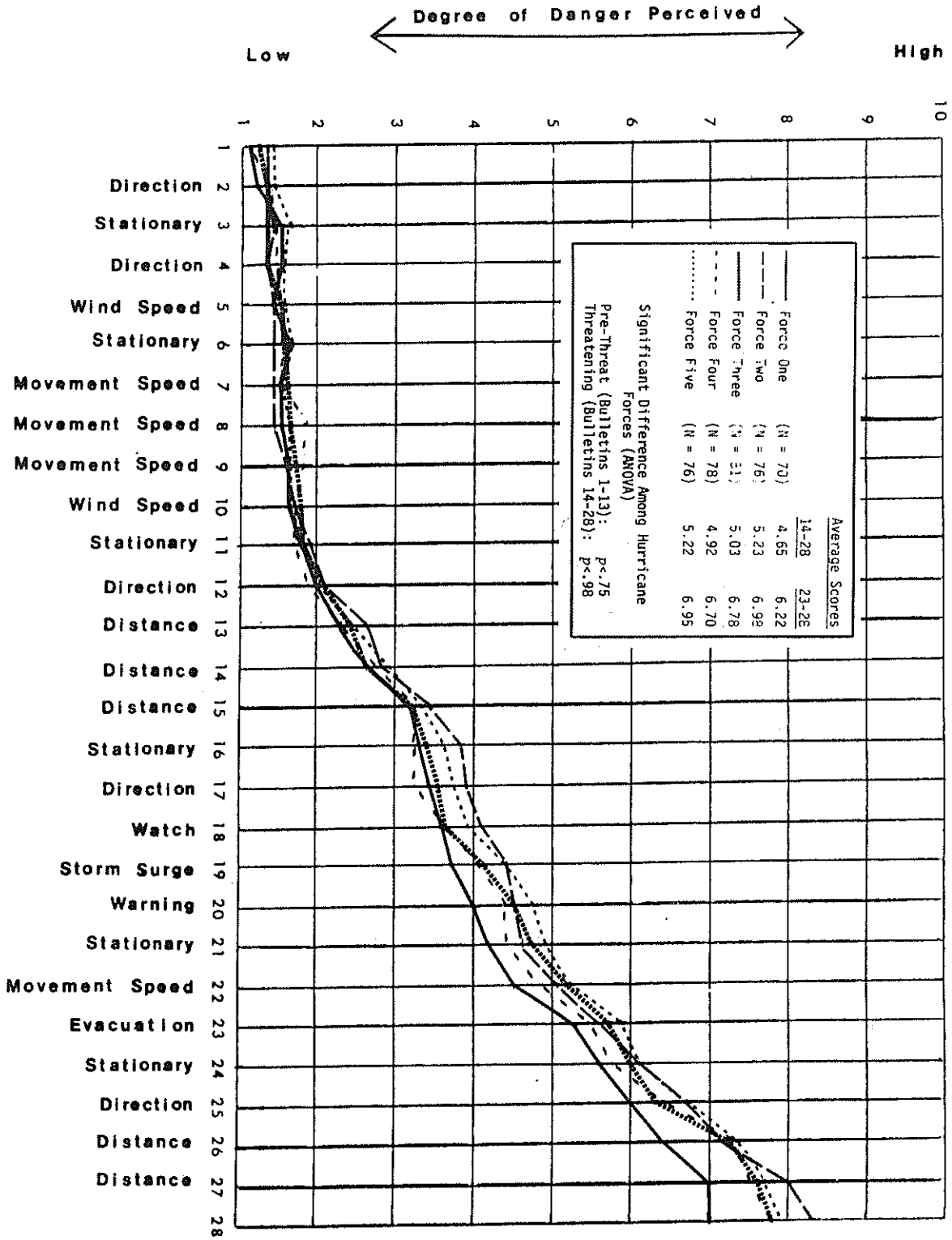

Figure 2-4-M
Influence of Hurricane Force on Perception of Danger

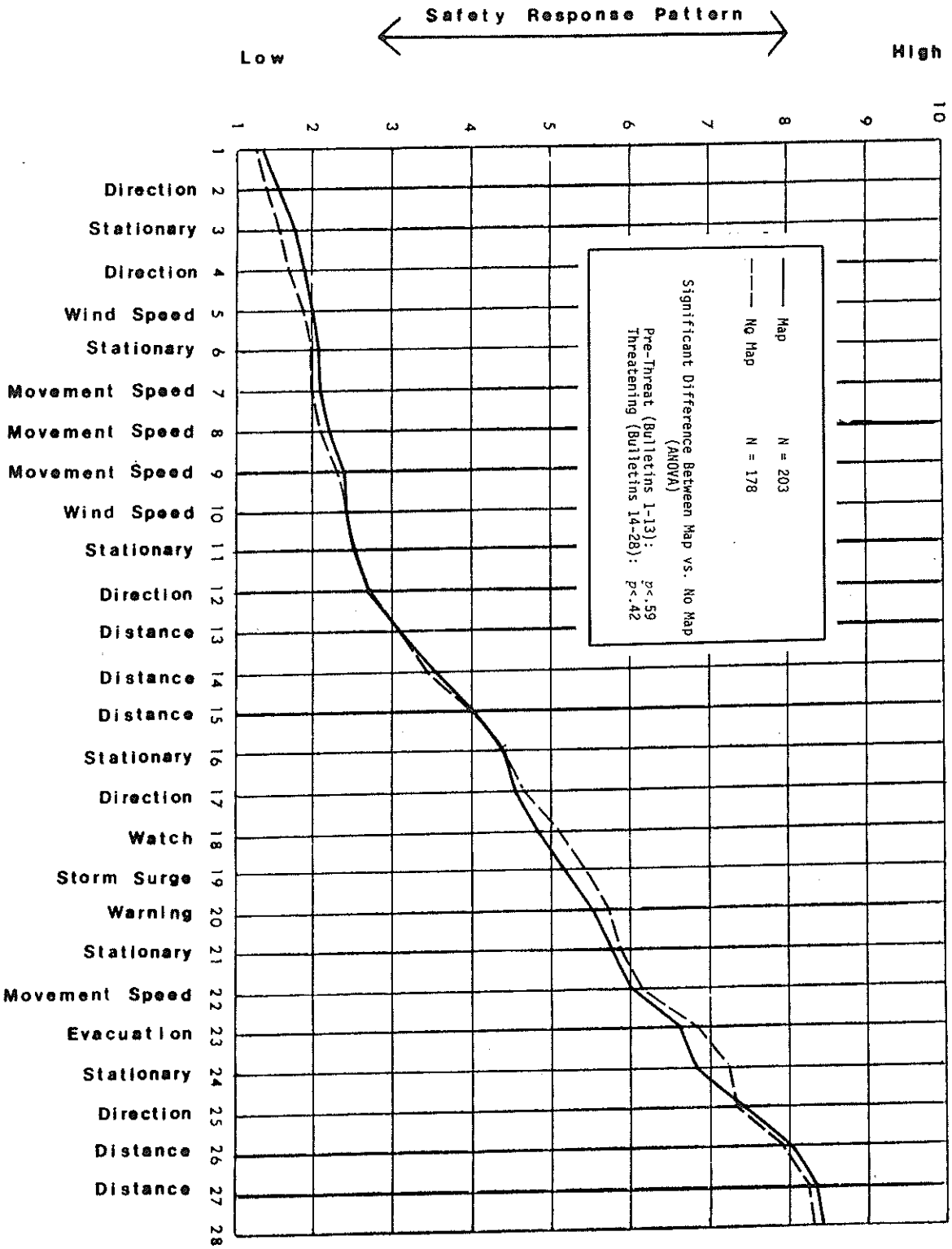

Figure 2-5
Influence of Possession of Hurricane Tracking Maps on Response Patterns

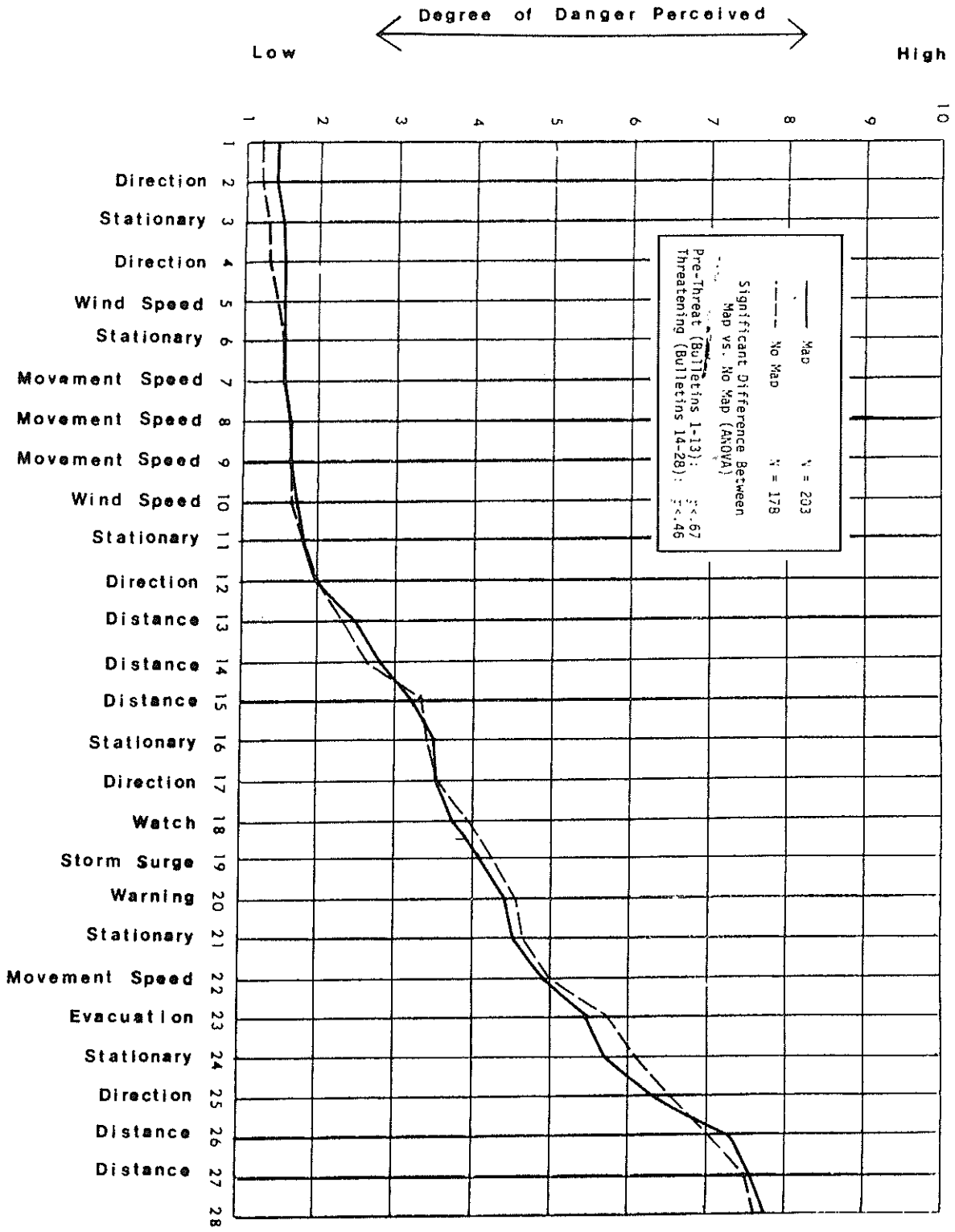

Figure 2-6
Influence of Possession of Hurricane Tracking
Maps on Perception of Danger

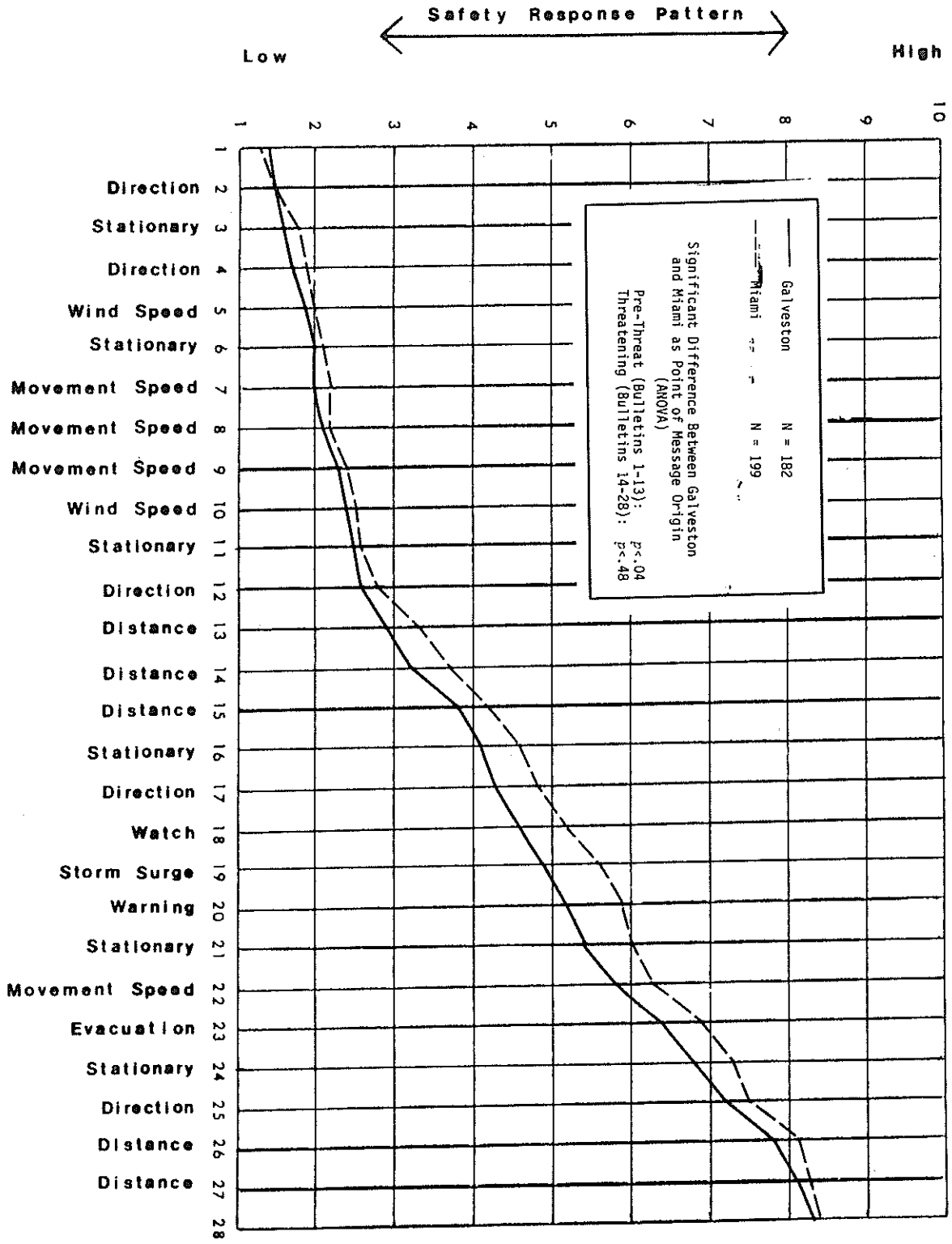

Figure 2-7
Influence of Message Origin on Response Patterns

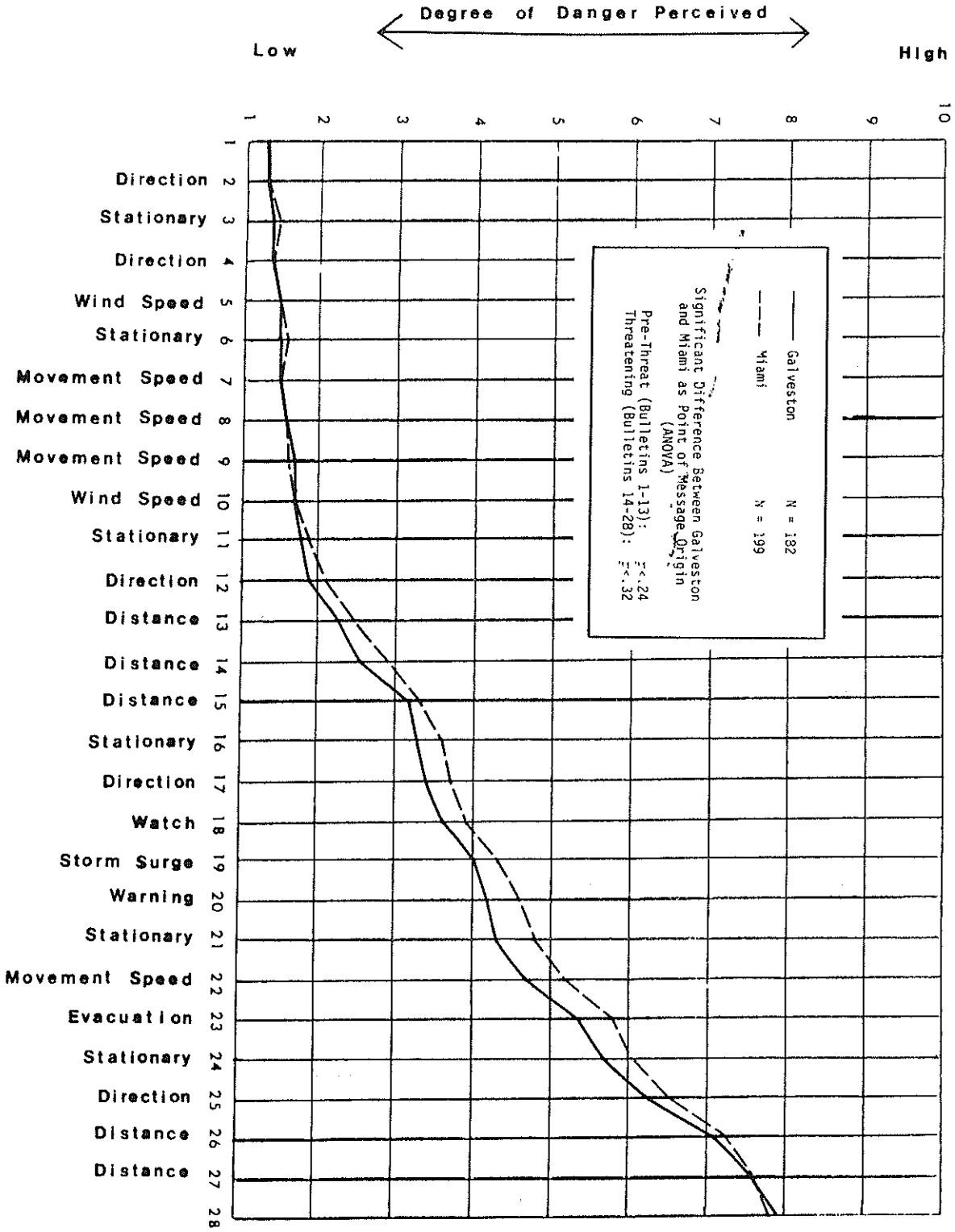

Figure 2-8
Influence of Message Origin on Perception of Danger

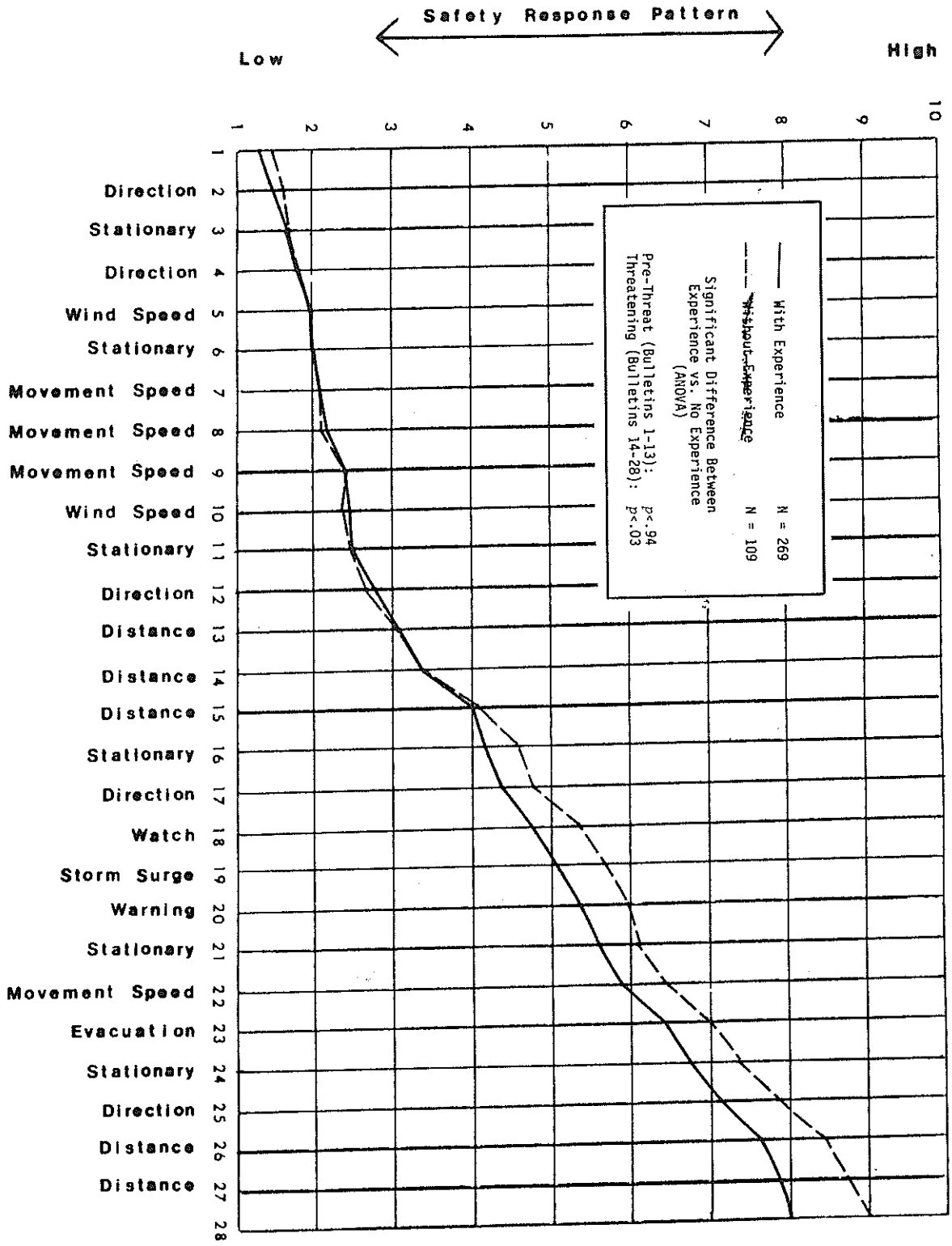

Figure 2-9
Influence of Hurricane Experience on Response Patterns

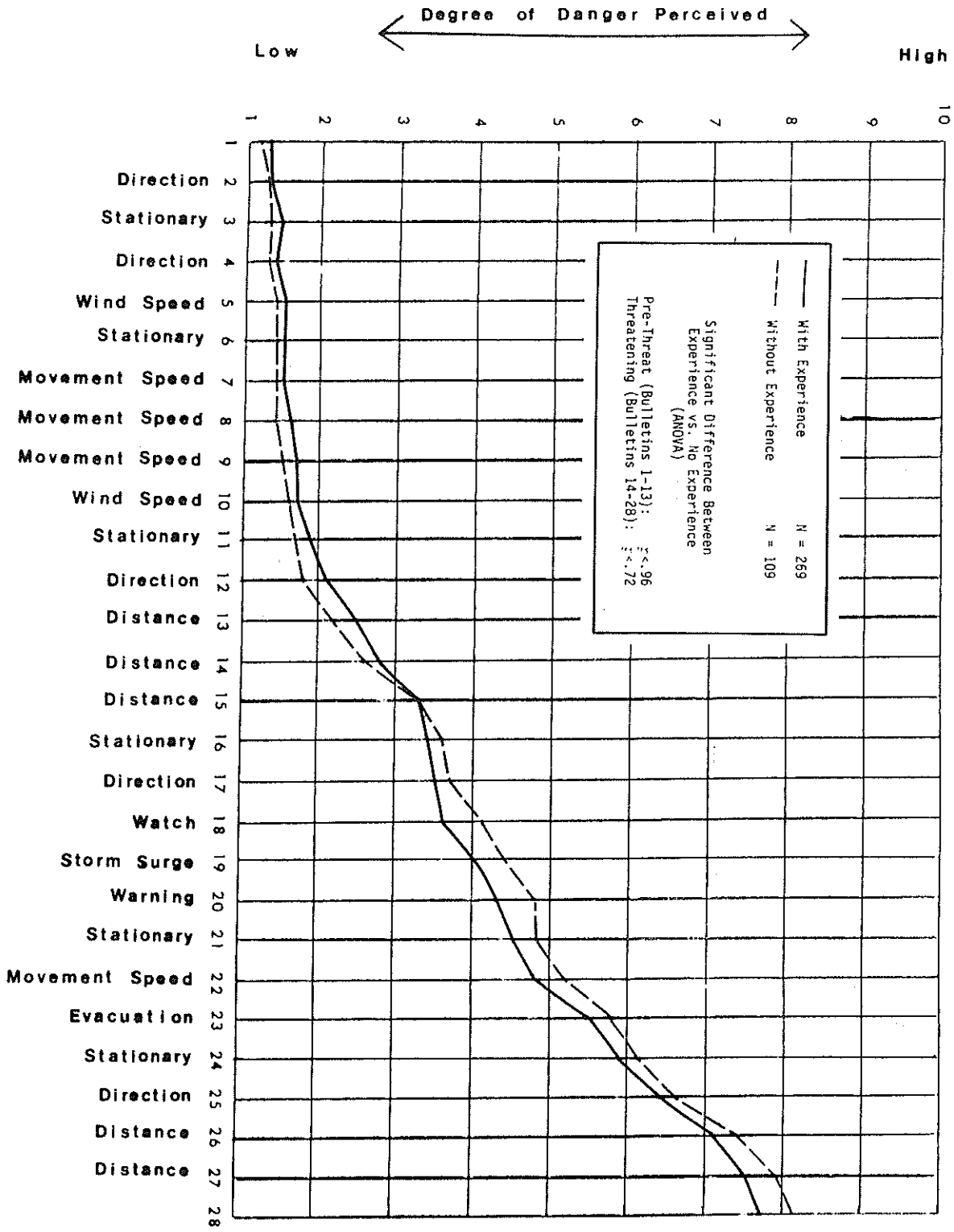

Figure 2-10
Influence of Hurricane Experience on Perception of Danger

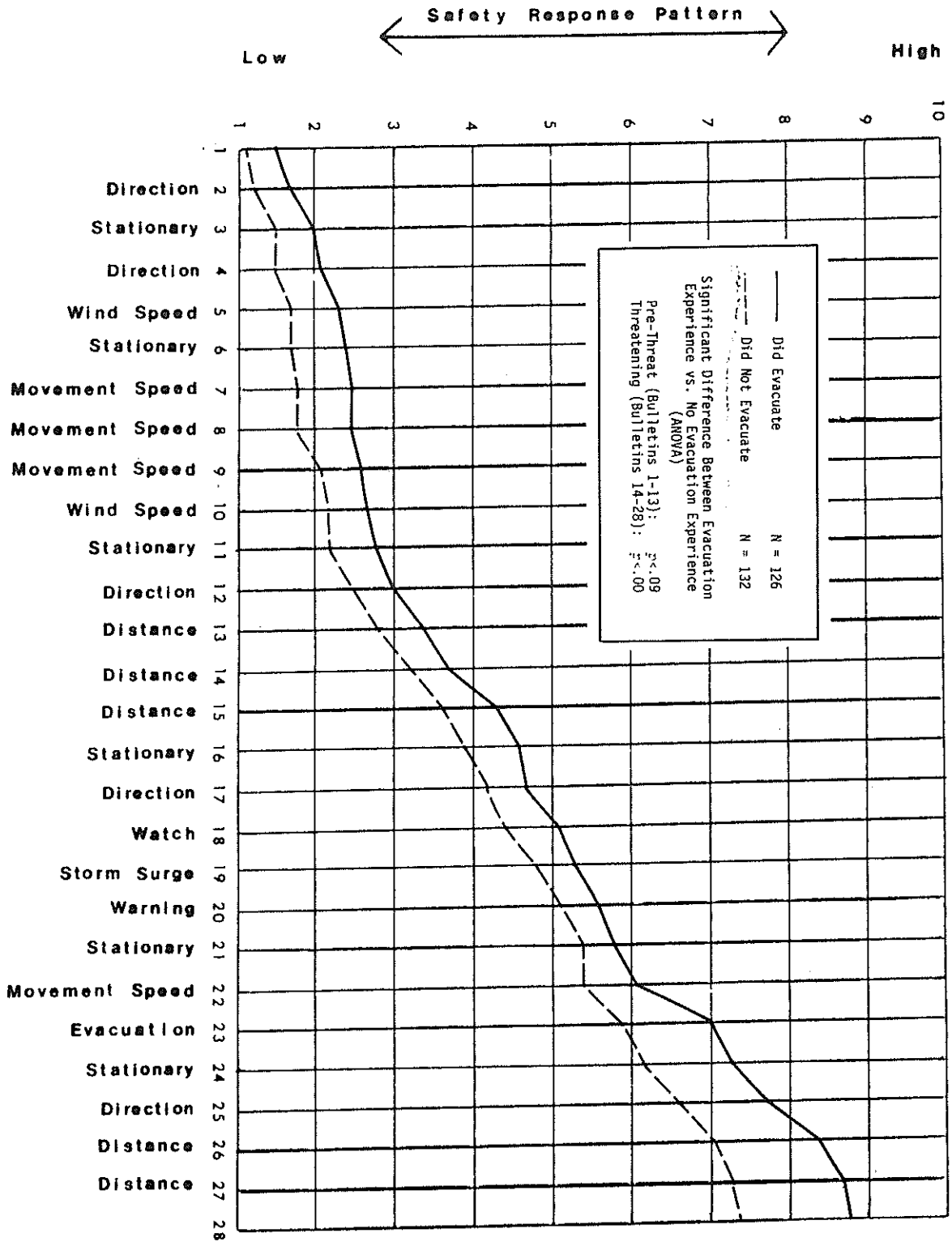

Figure 2-11
Influence of Evacuation Experience for Those With Hurricane Experience on Response Patterns

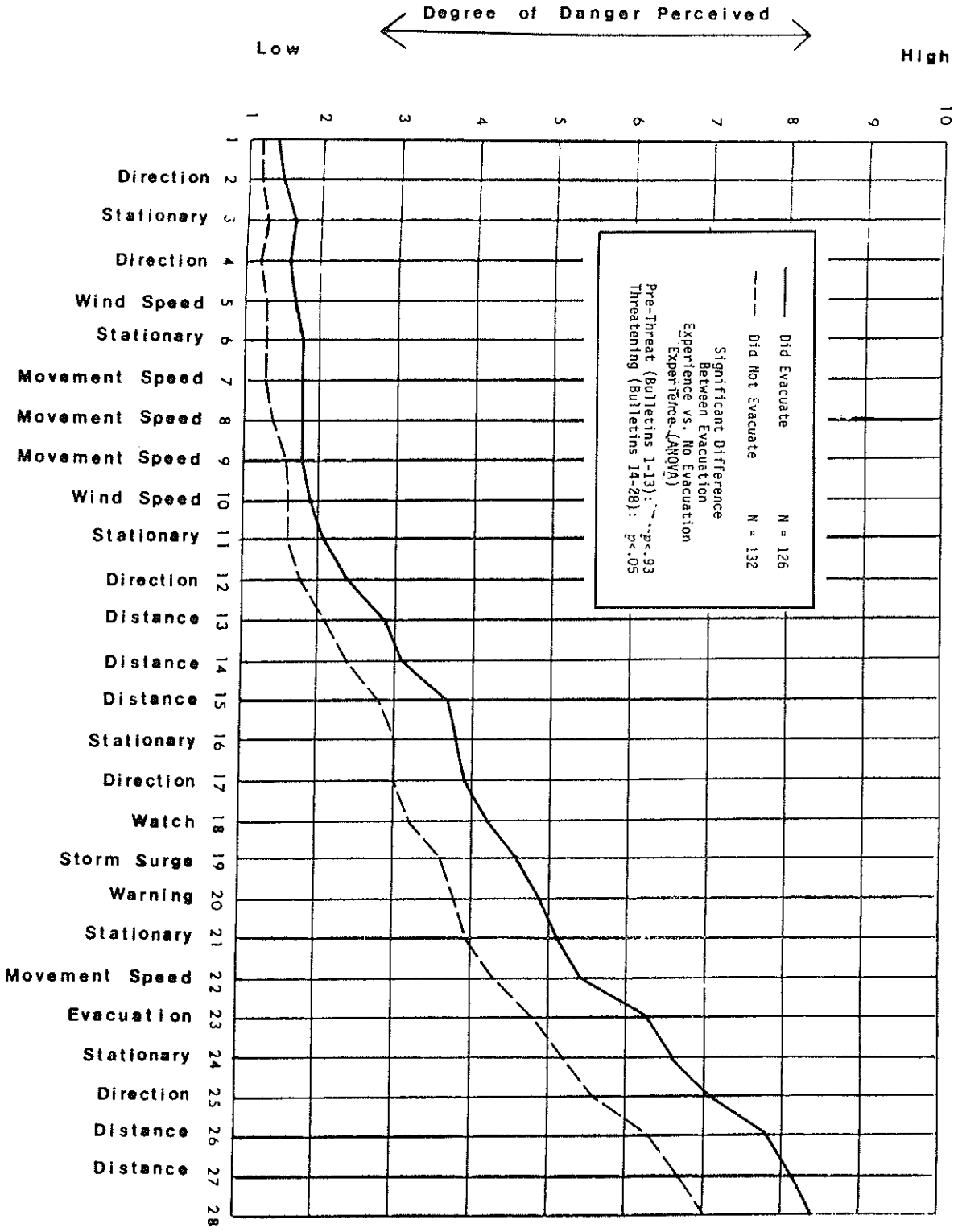

Figure 2-12
Influence of Evacuation Experience for Those With
Hurricane Experience on Perception of Danger

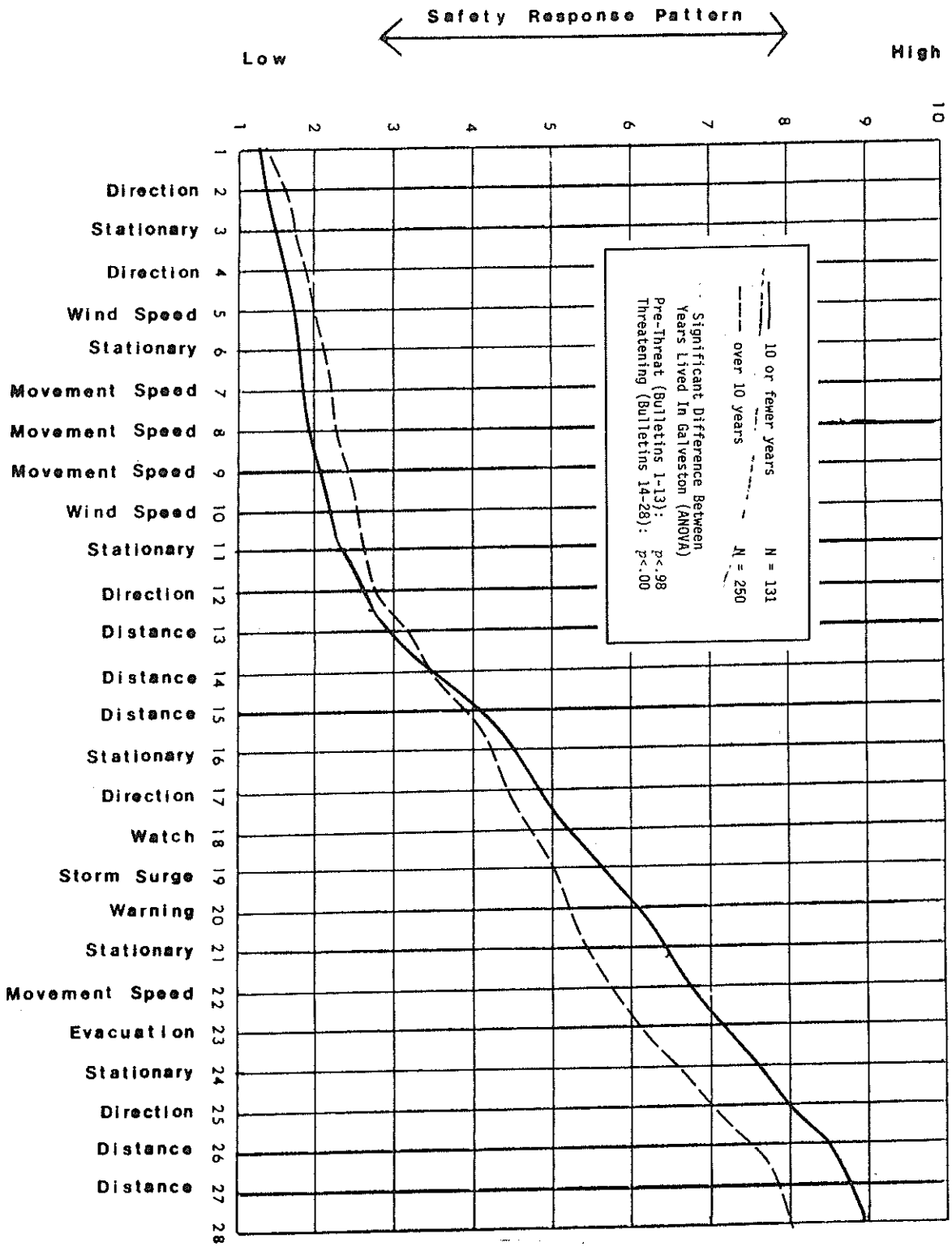

Figure 2-13
Influence of Years Lived In Galveston on
Response Patterns

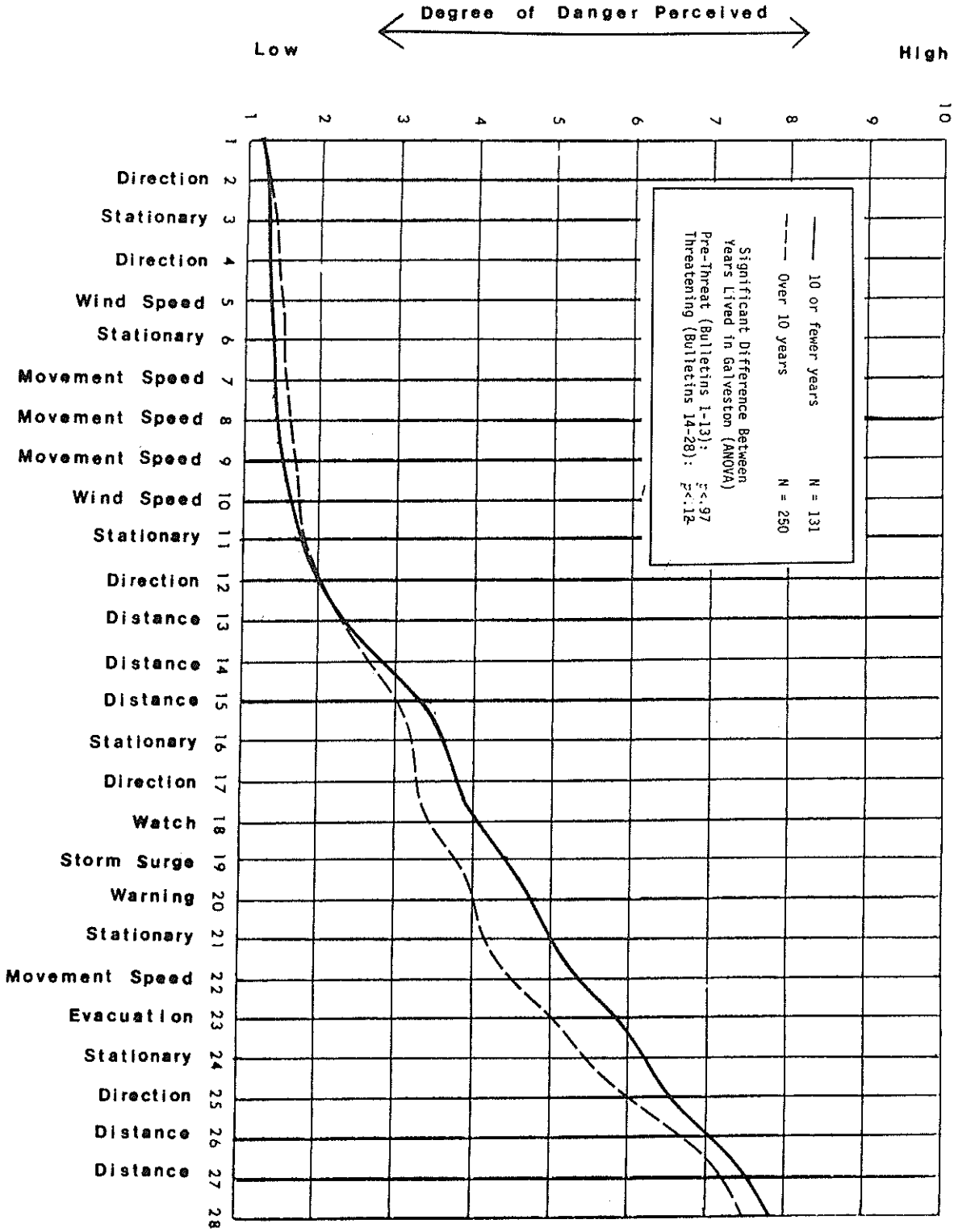

Figure 2-14
Influence of Years Lived in Galveston on
Perception of Danger

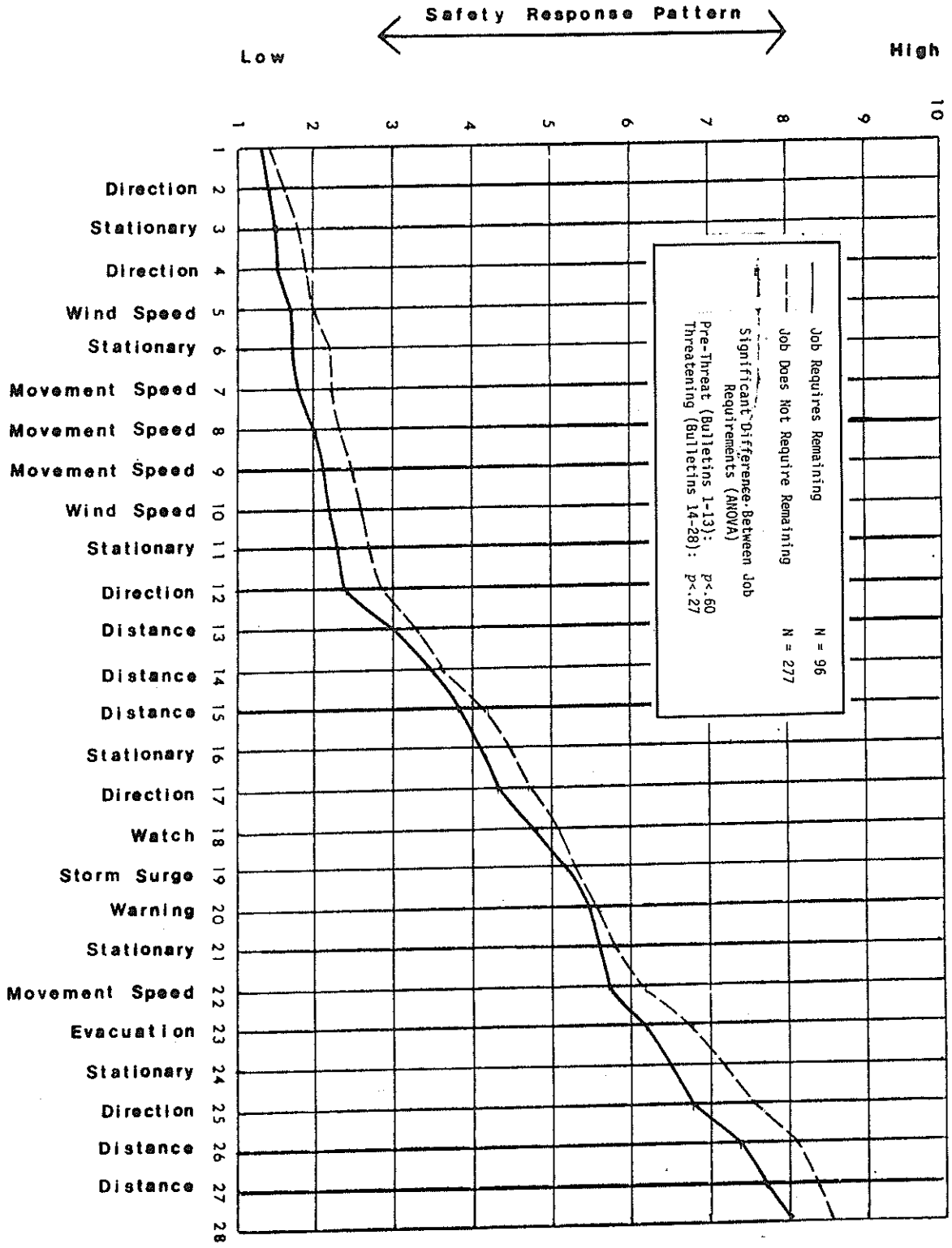

Figure 2-15
Influence of Job Requirement to Remain on
Island During Evacuation on Response Patterns

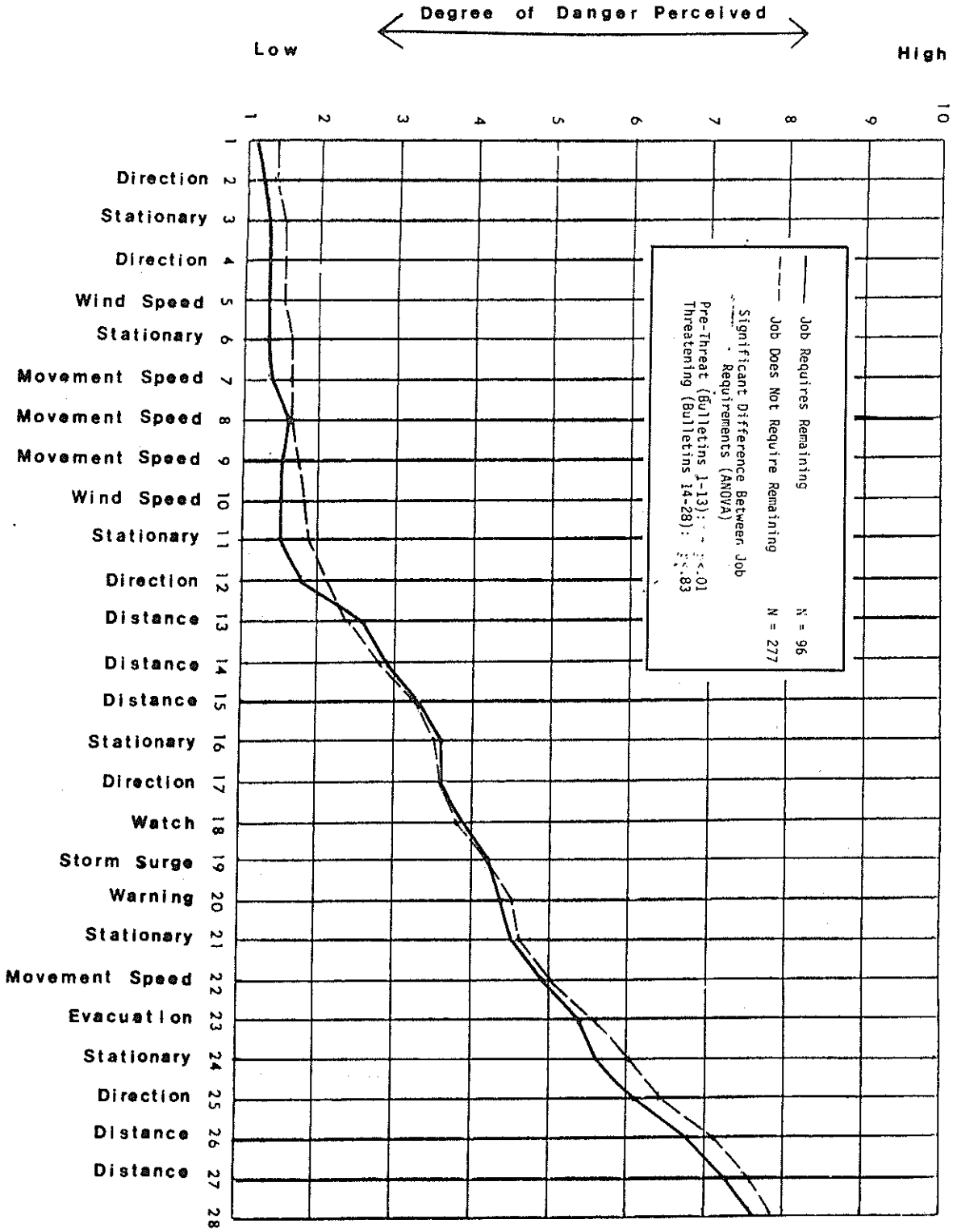

Figure 2-16
Influence of Job Requirement to Remain on
Island During Evacuation on Perception of Danger

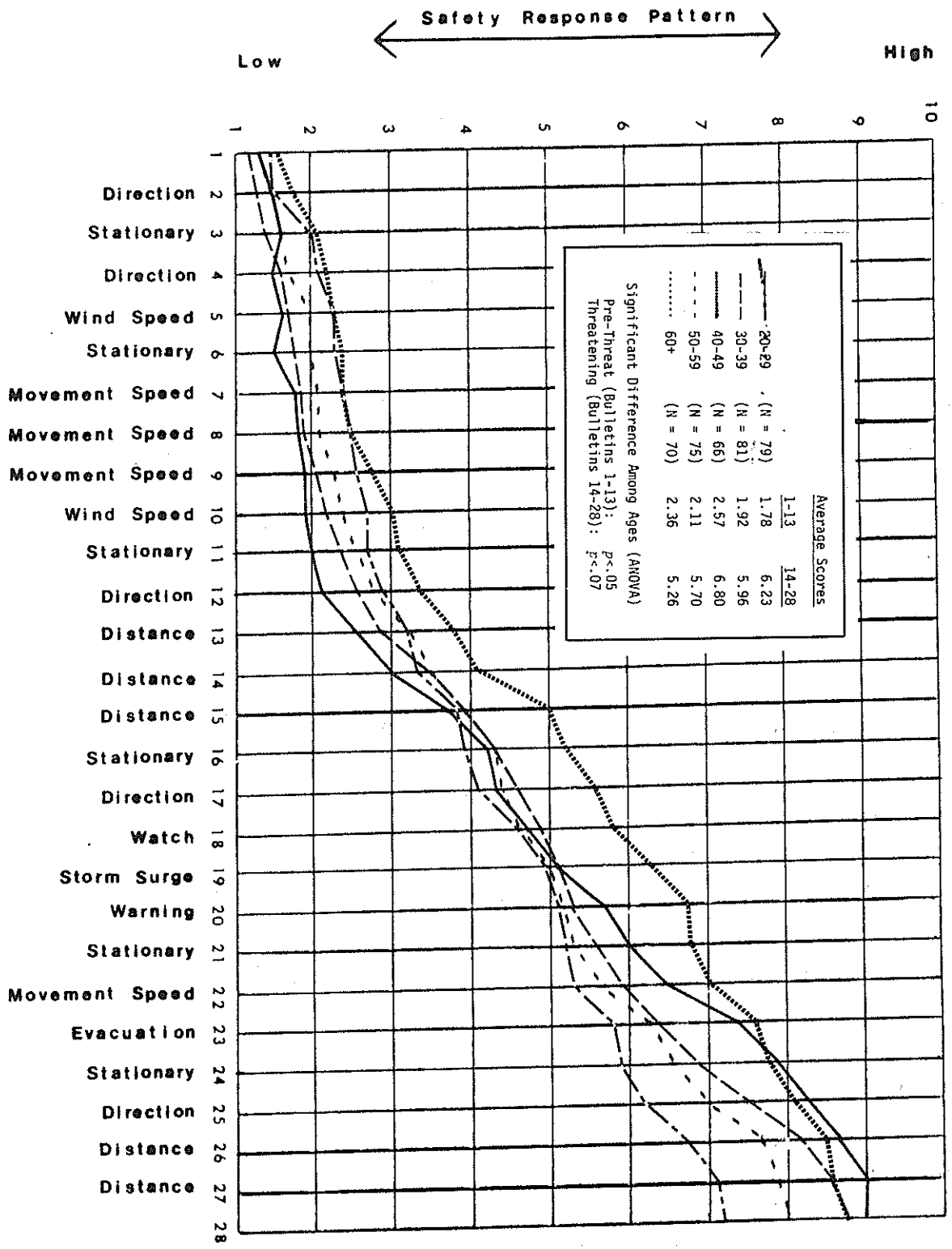

Figure 2-17
Influence of Age on Response Patterns

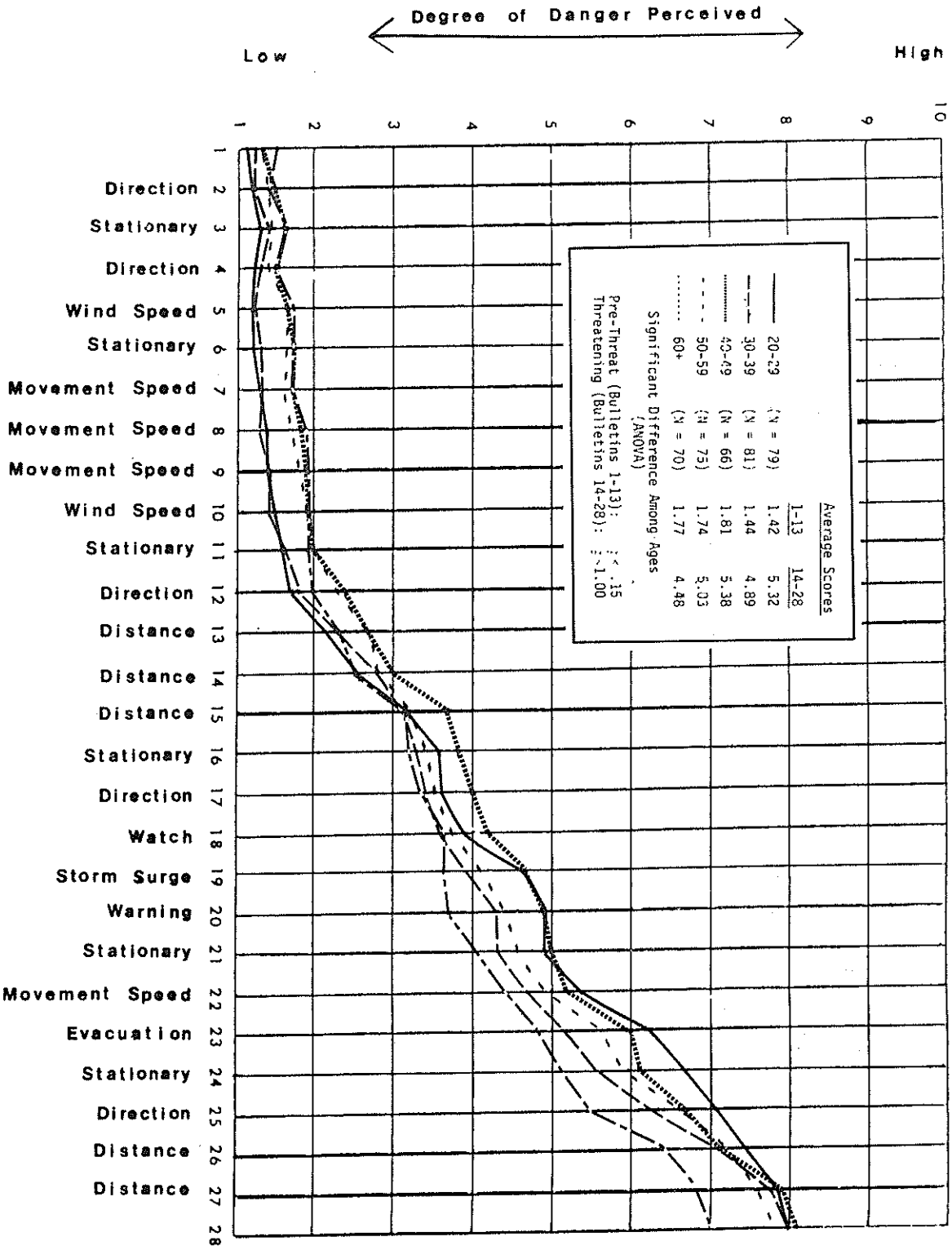

Figure 2-18
Influence of Age on Perception of Danger

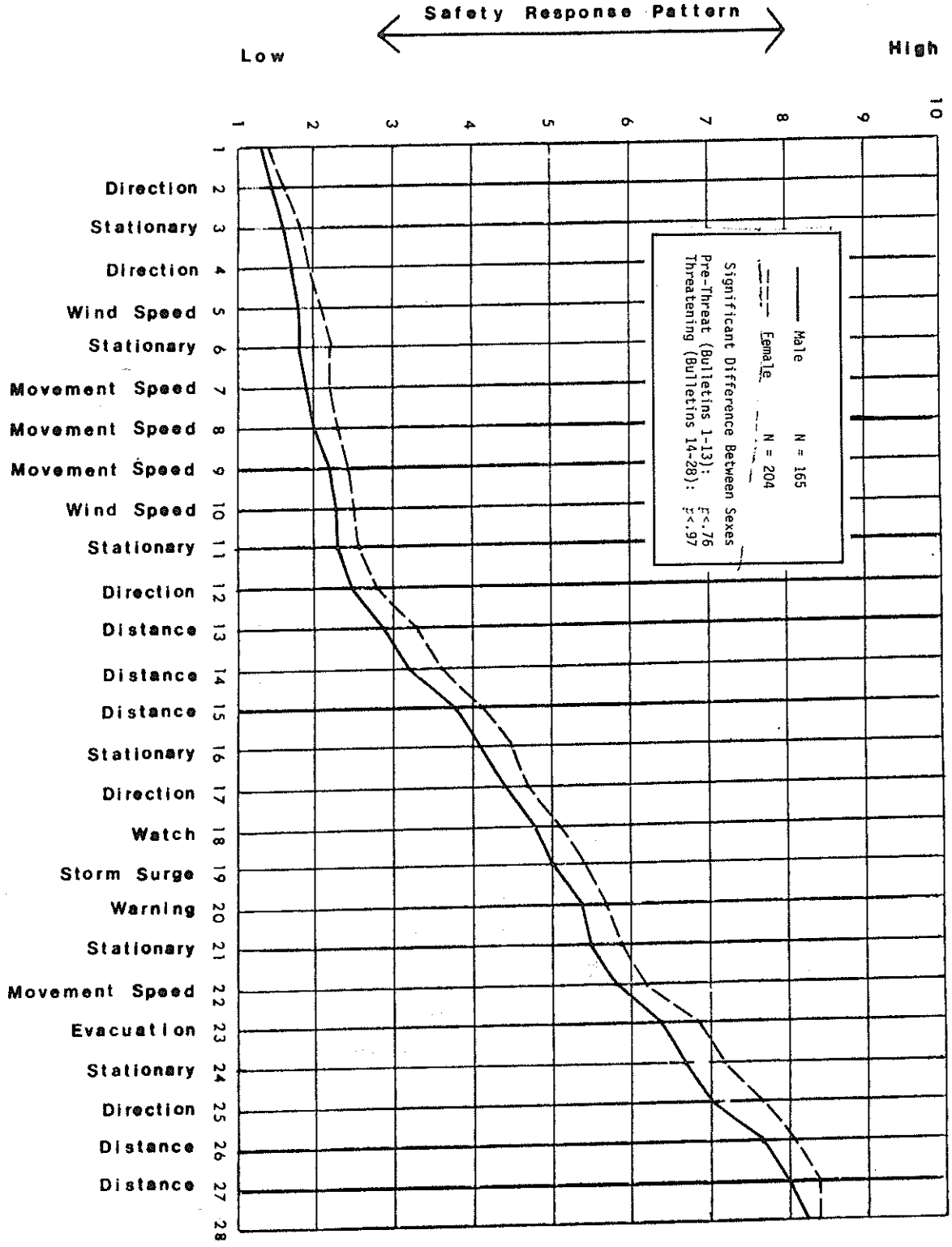

Figure 2-19
Influence of Sex of Interviewee on Response Patterns

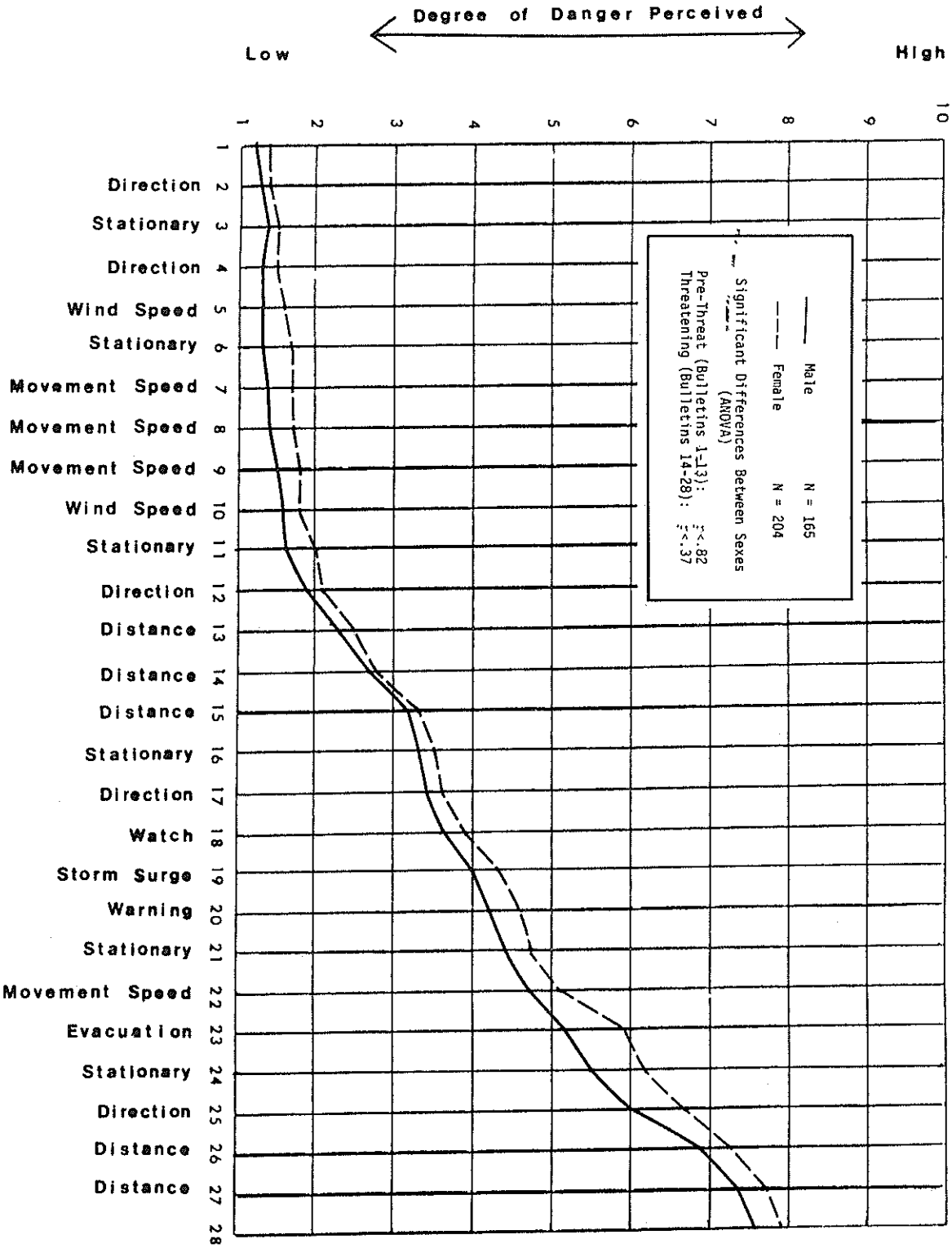

Figure 2-20
Influence of Sex of Interviewee on Perception of Danger

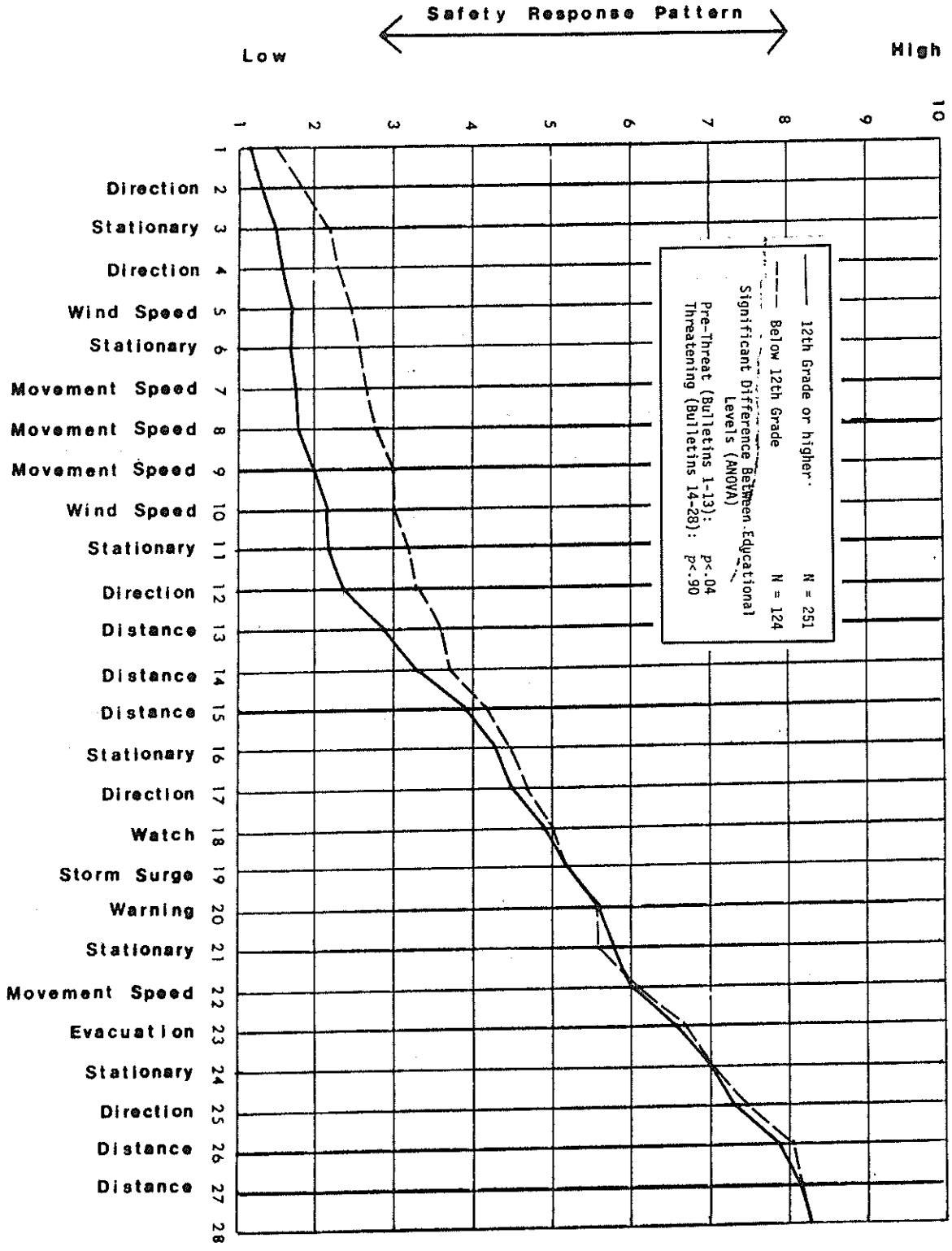

Figure 2-21
Influence of Educational Level on Response Patterns

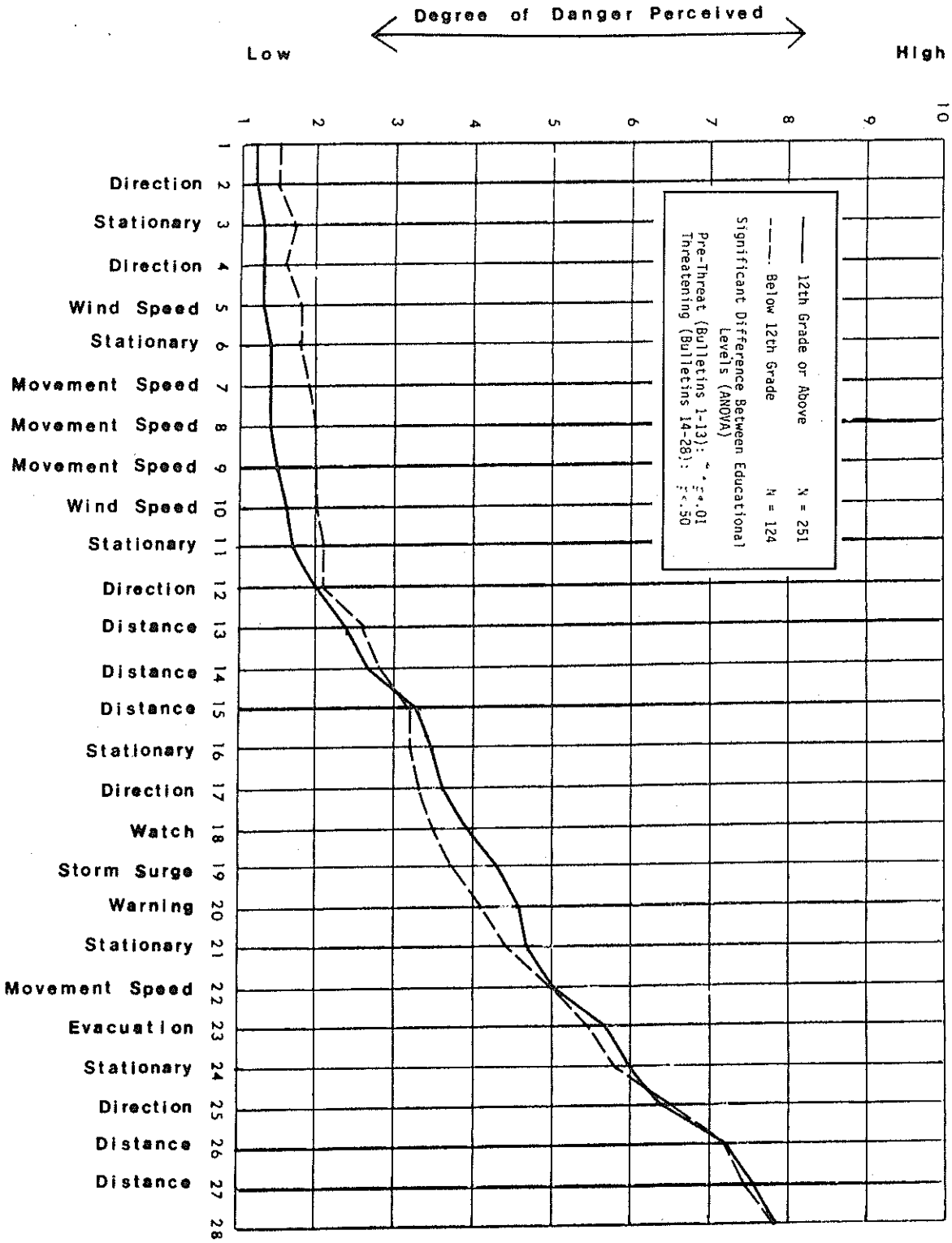

Figure 2-22
Influence of Educational Level on Perception of Danger

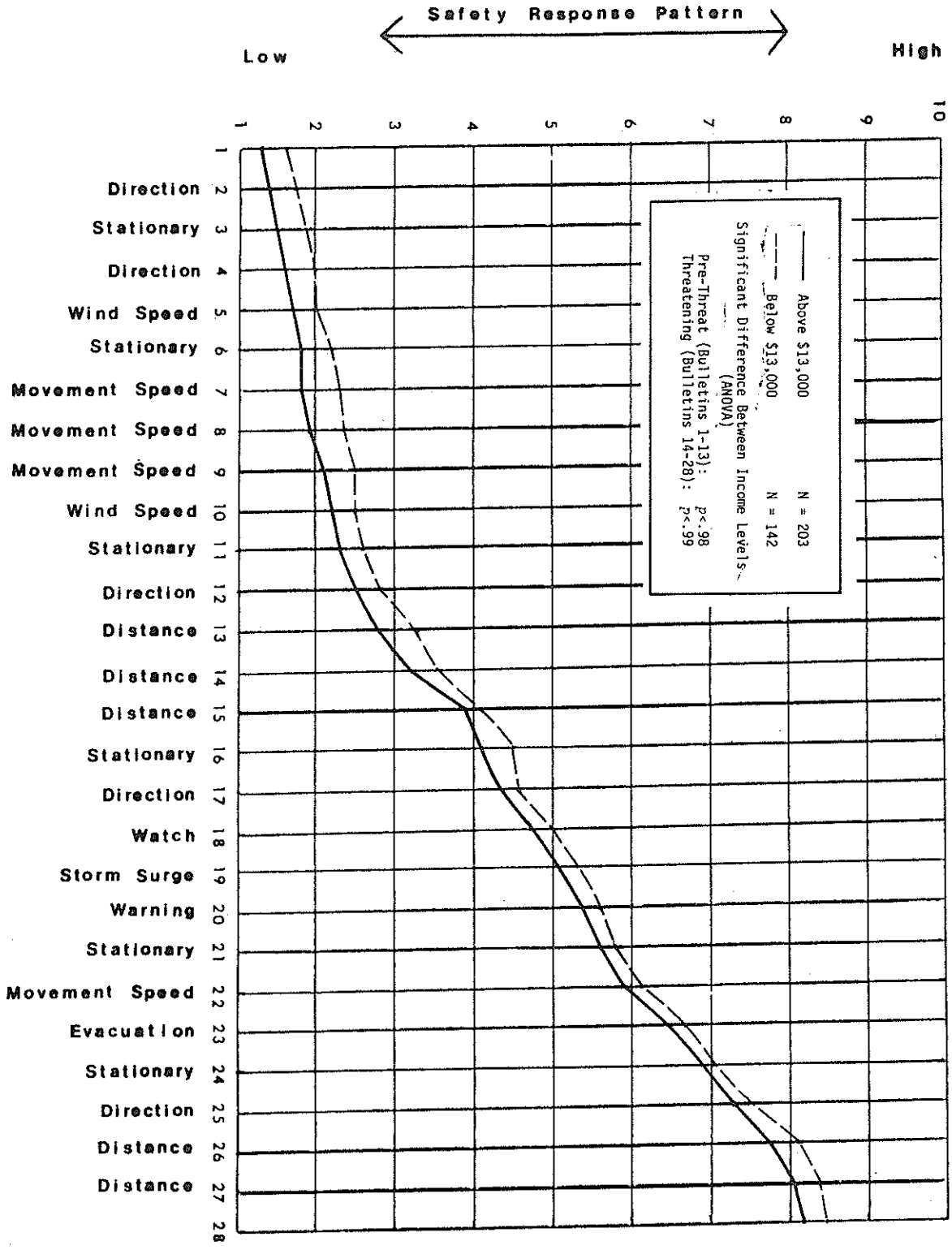

Figure 2-23
Influence of Income Level on Response Patterns

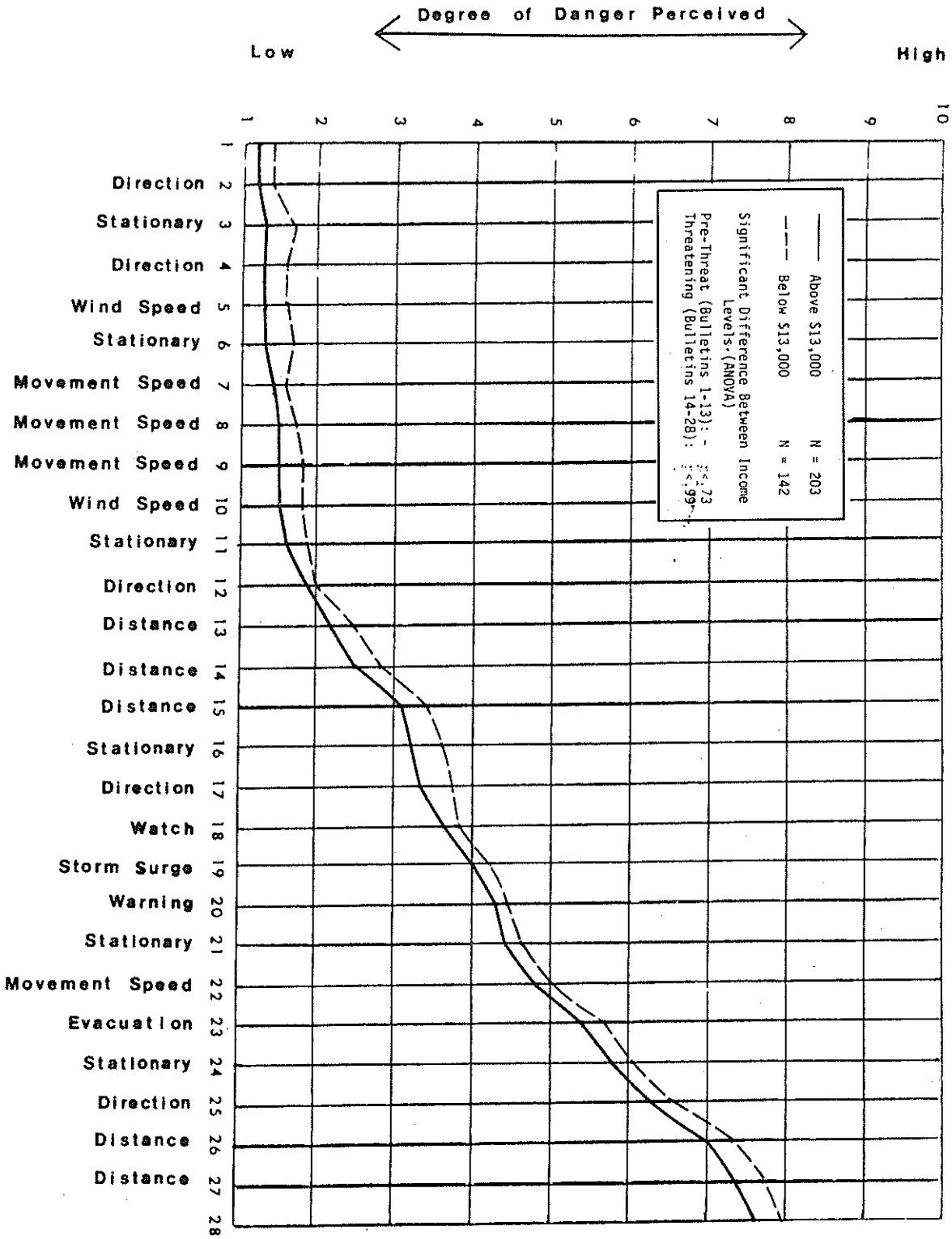

Figure 2-24
Influence of Income Level on Perception of Danger

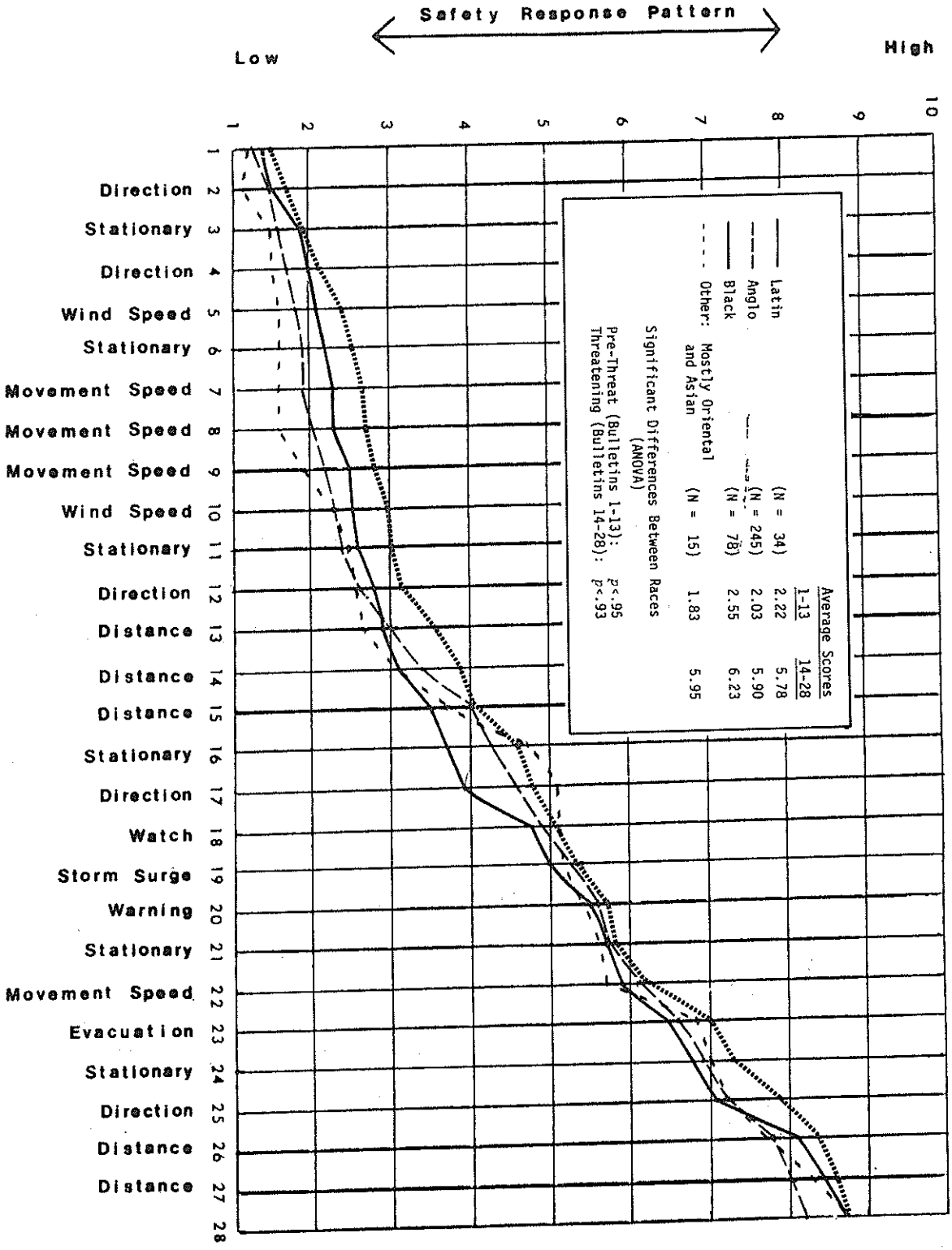

Figure 2-25-M
Influence of Race on Response Patterns

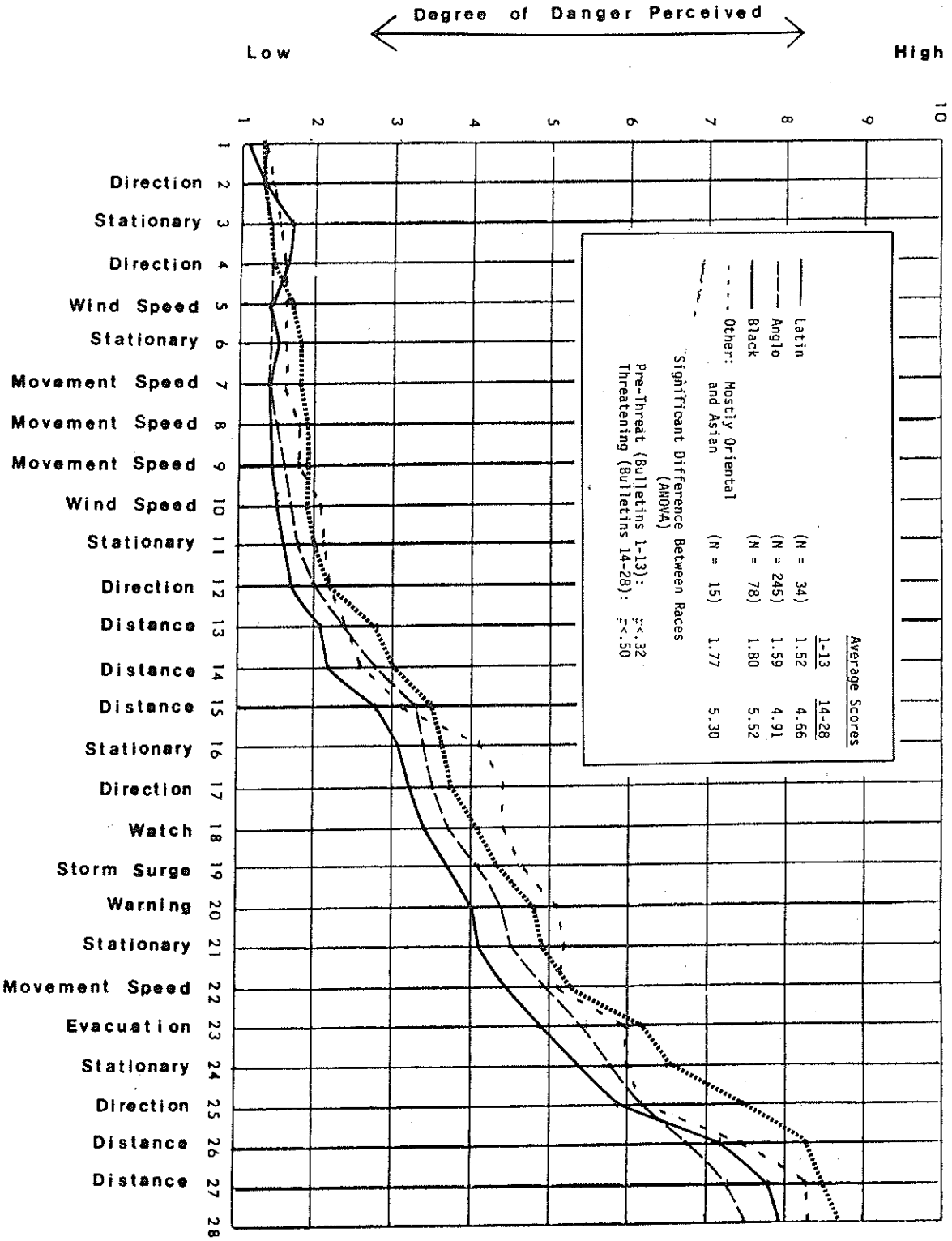

Figure 2-26-M
Influence of Race on Perception of Danger

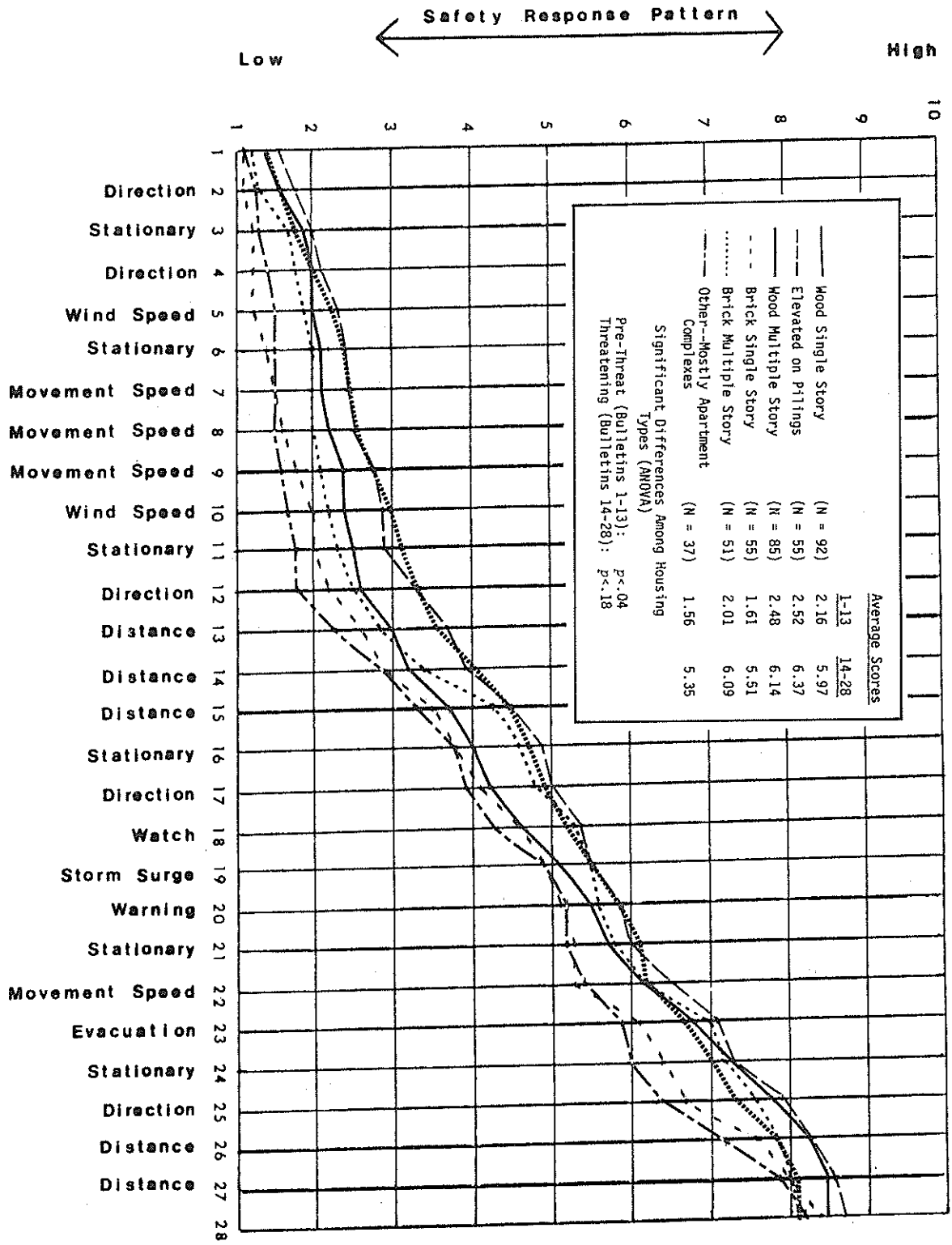

Figure 2-27
Influence of Housing Type on Response Patterns

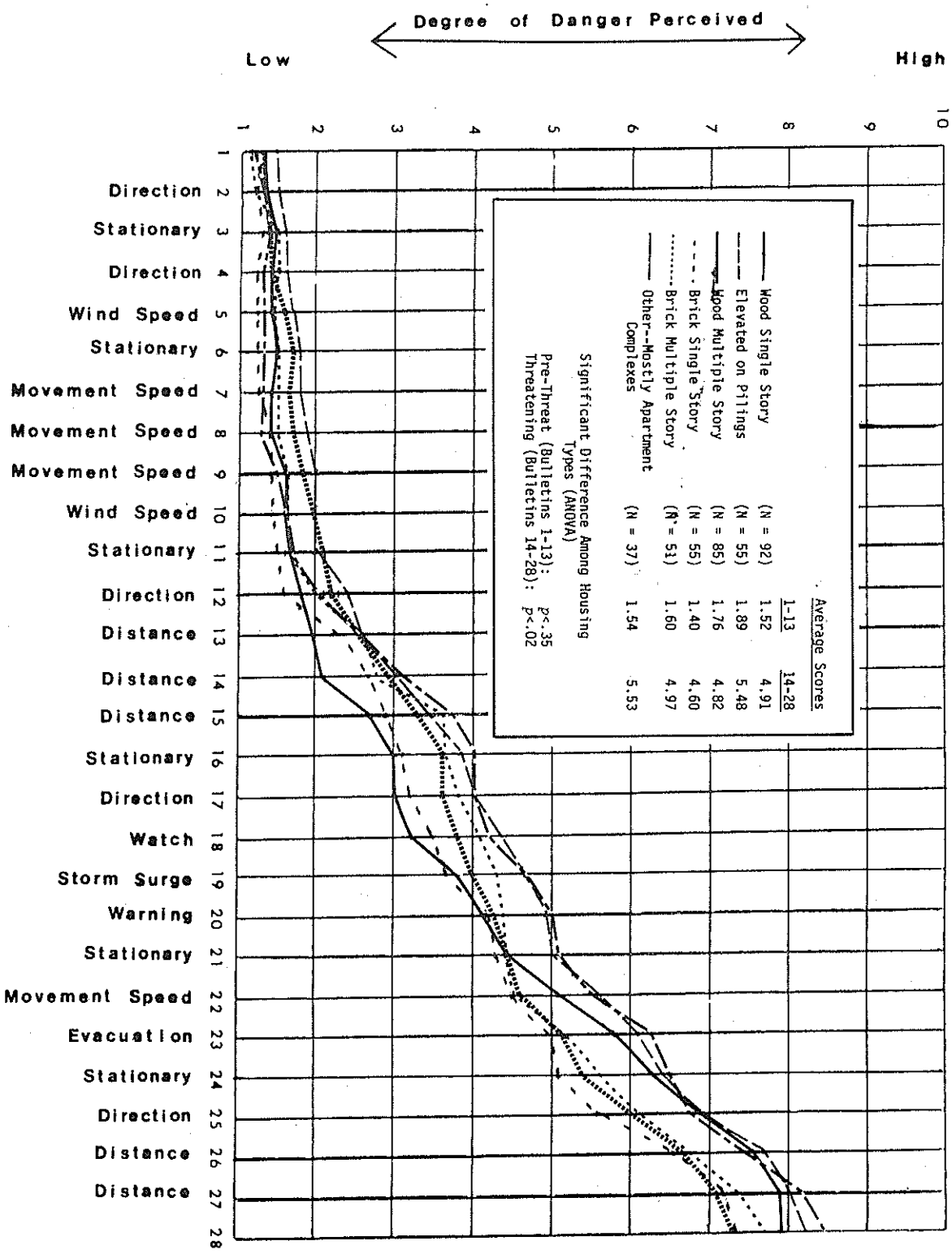

Figure 2-28
Influence of Housing Type on Perception of Danger

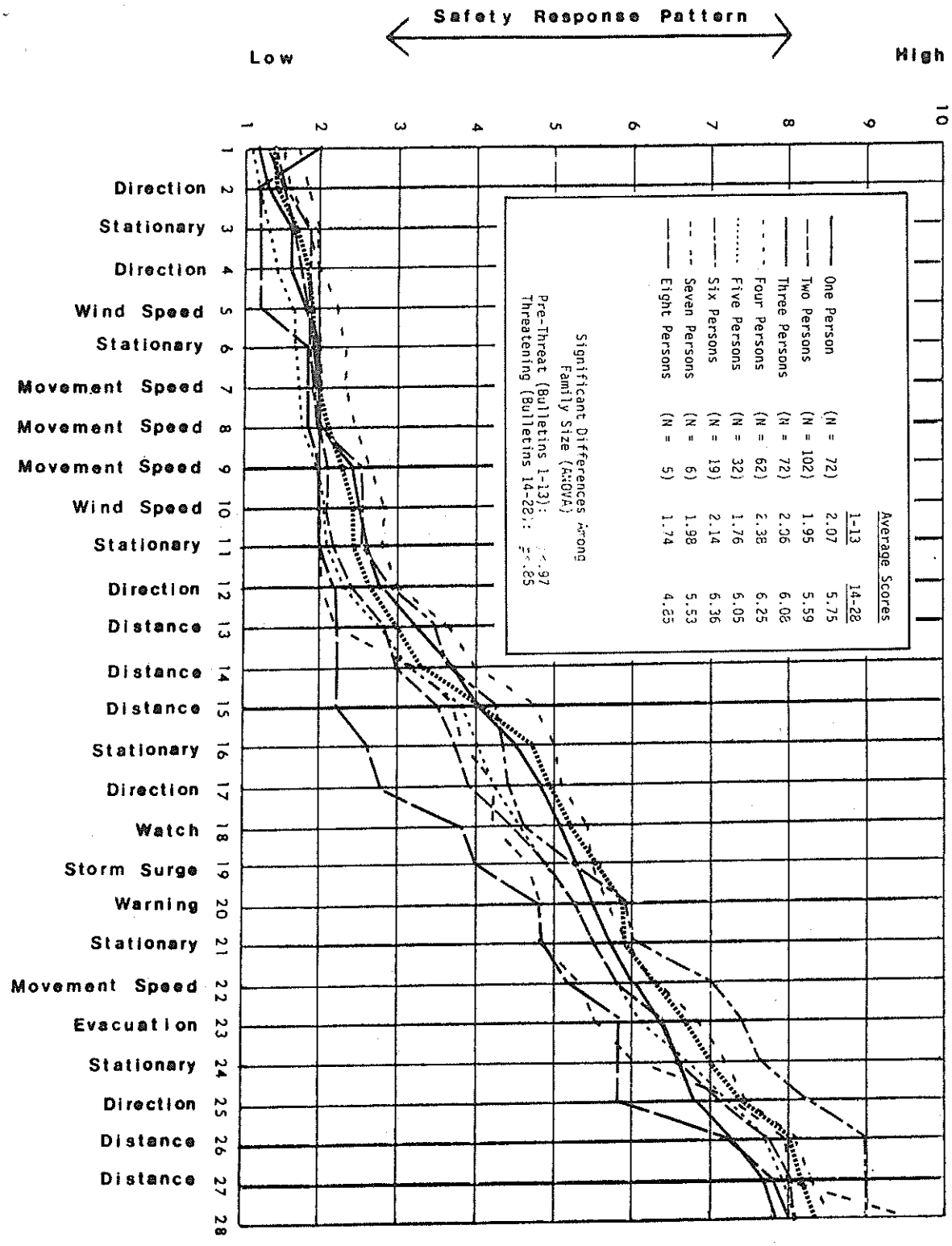

Figure 2-29
Influence of Family Size on Response Patterns

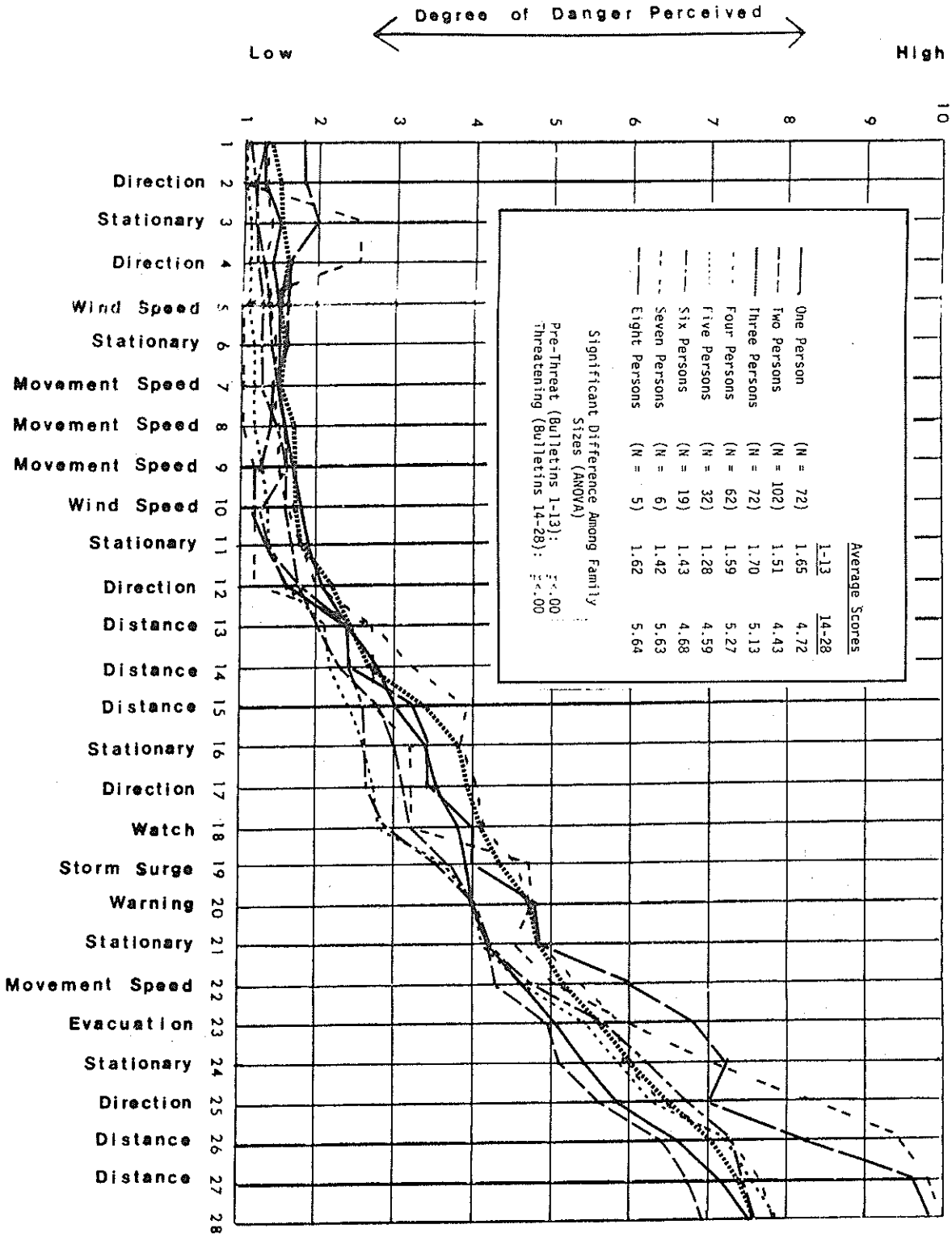

Figure 2-30
Influence of Family Size on Perception of Danger

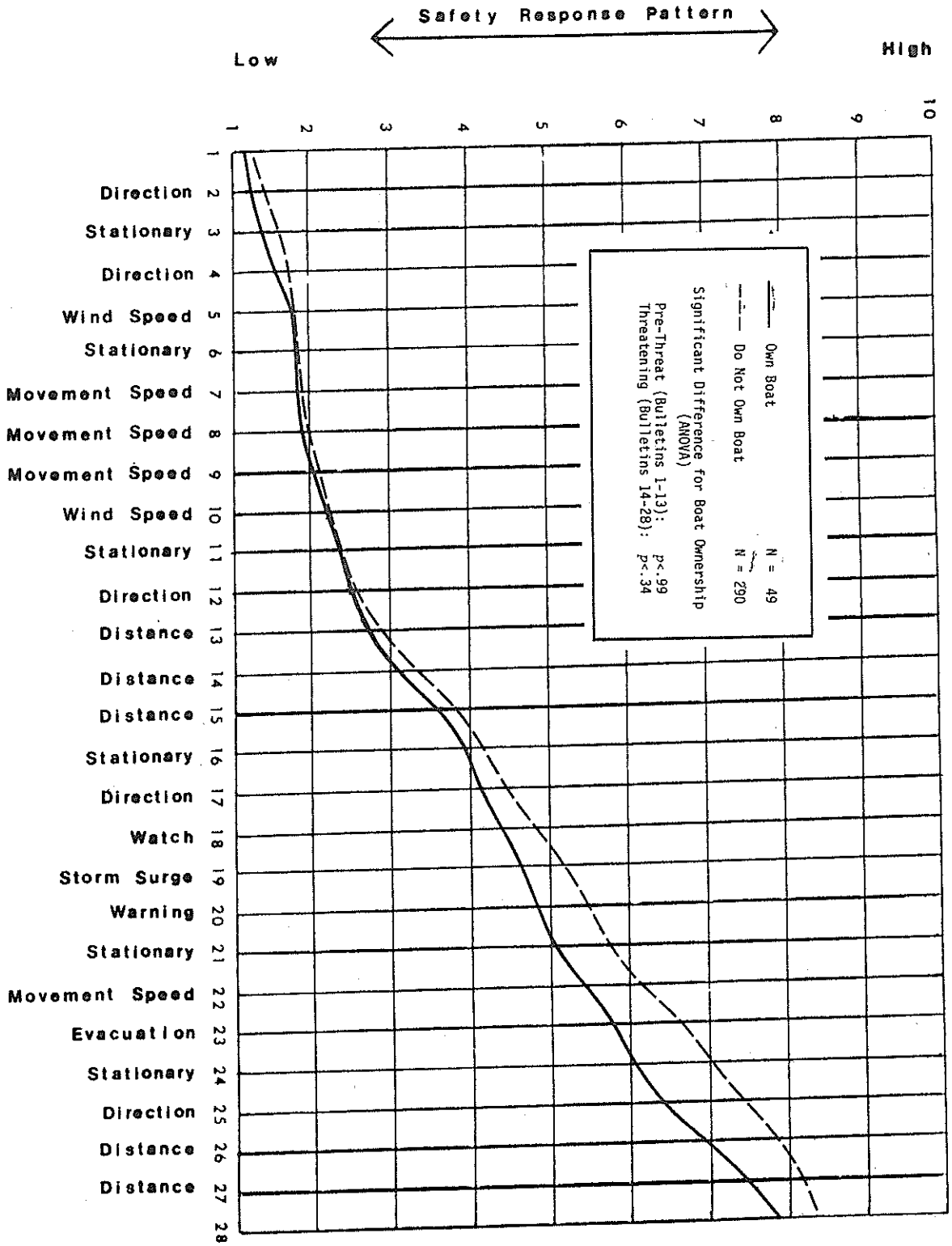

Figure 2-31
Influence of Boat Ownership on Response Patterns

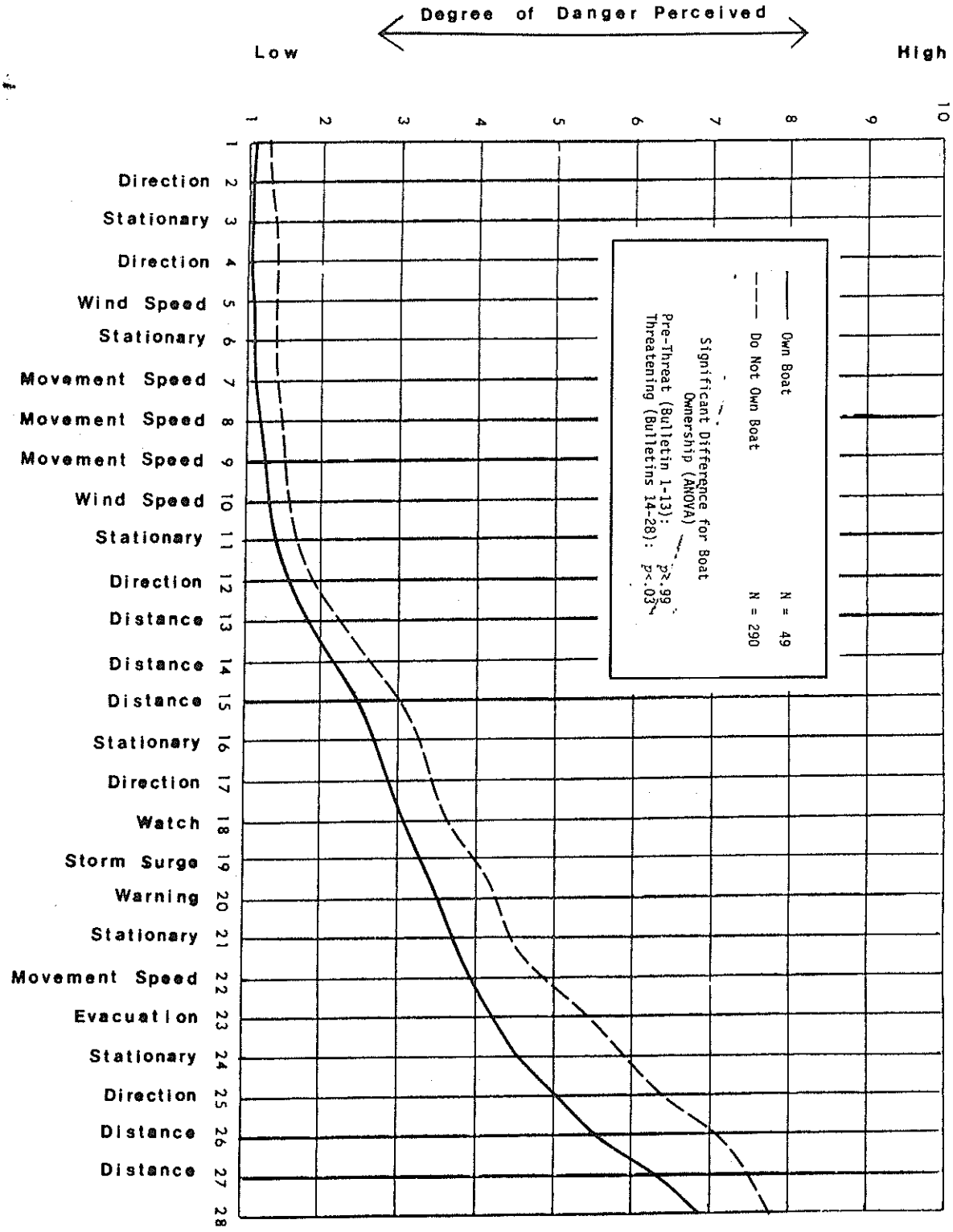

Figure 2-32
Influence of Boat Ownership on Perception of Danger

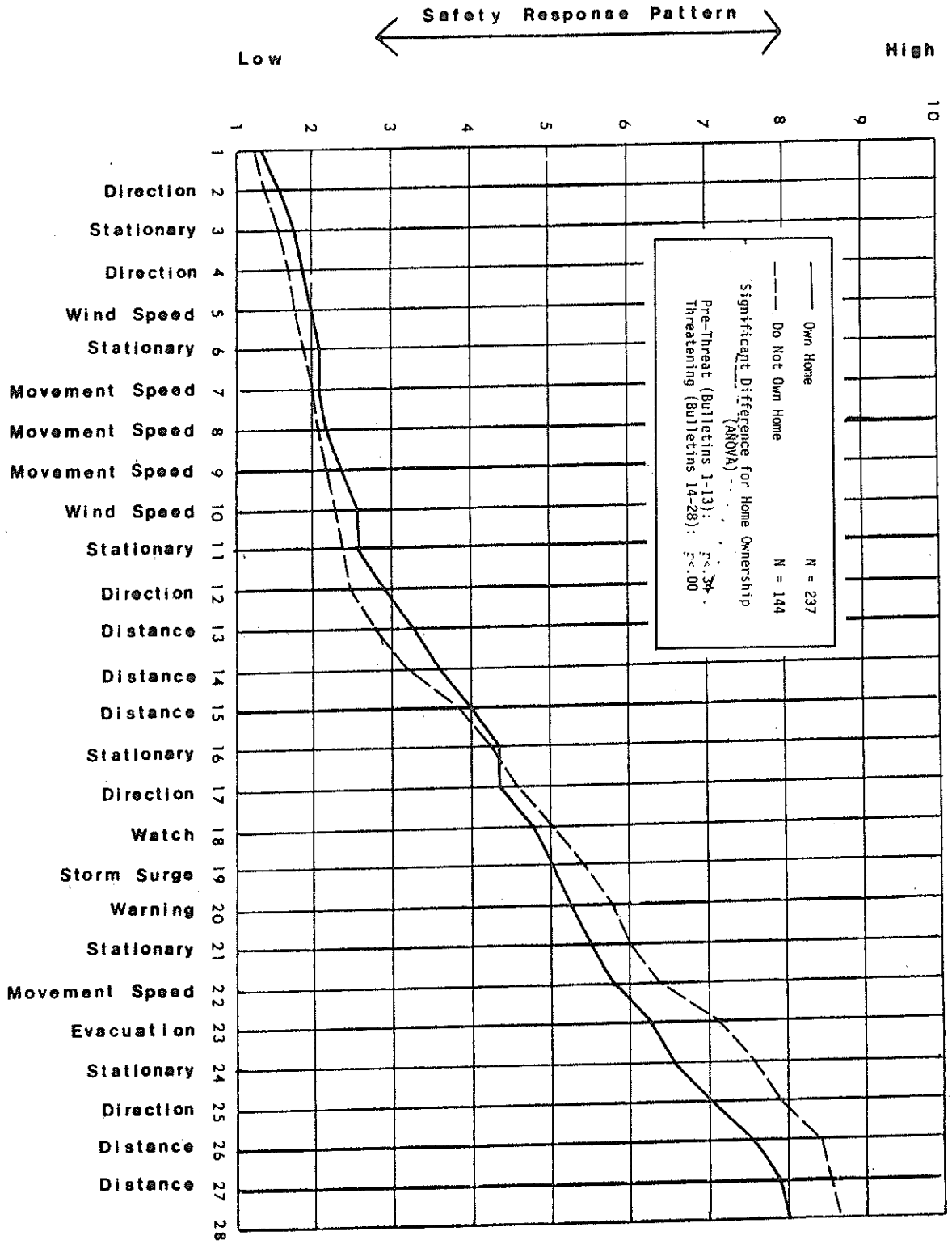

Figure 2-33
Influence of Home Ownership on Response Patterns

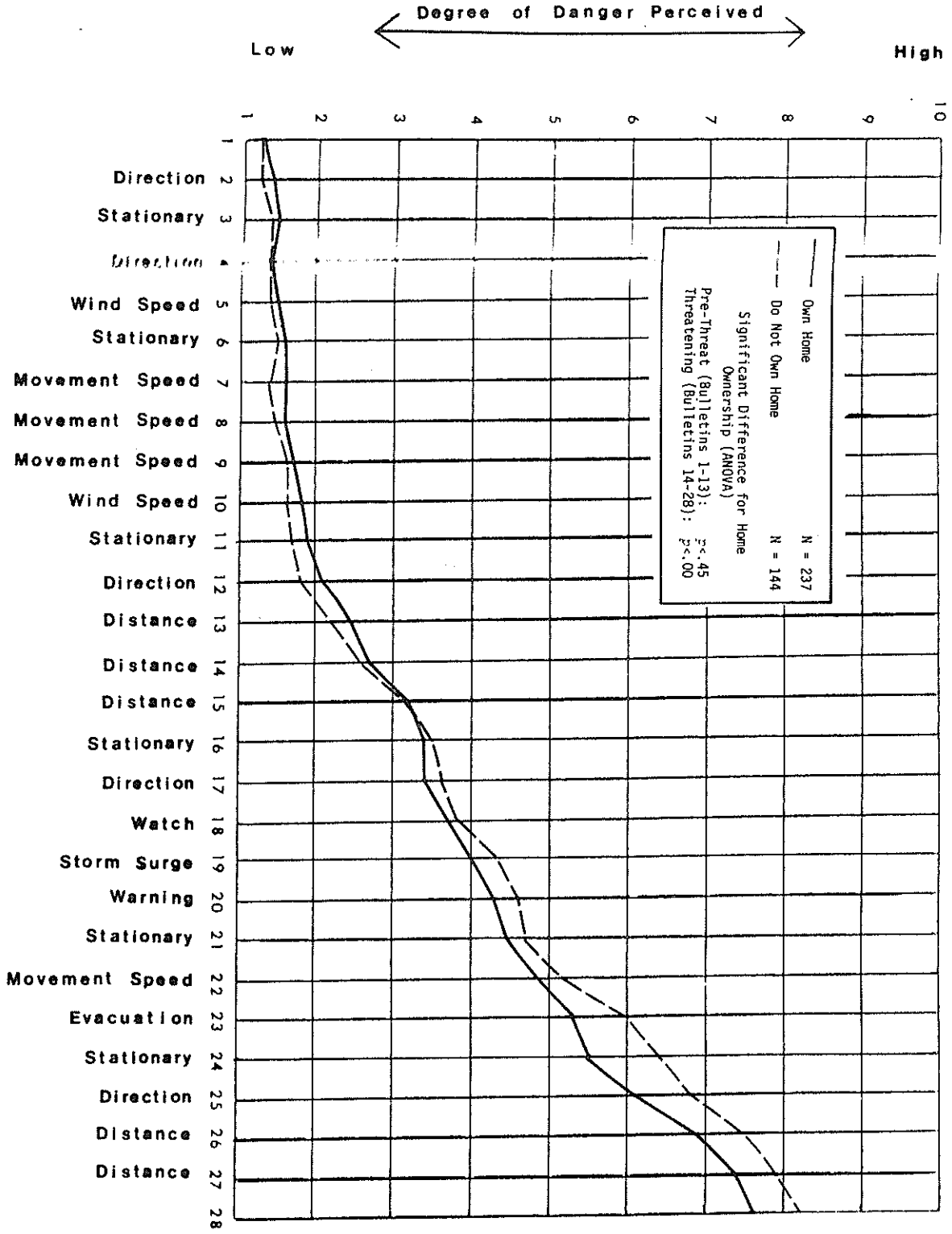

Figure 2-34
Influence of Home Ownership on Perception of Danger

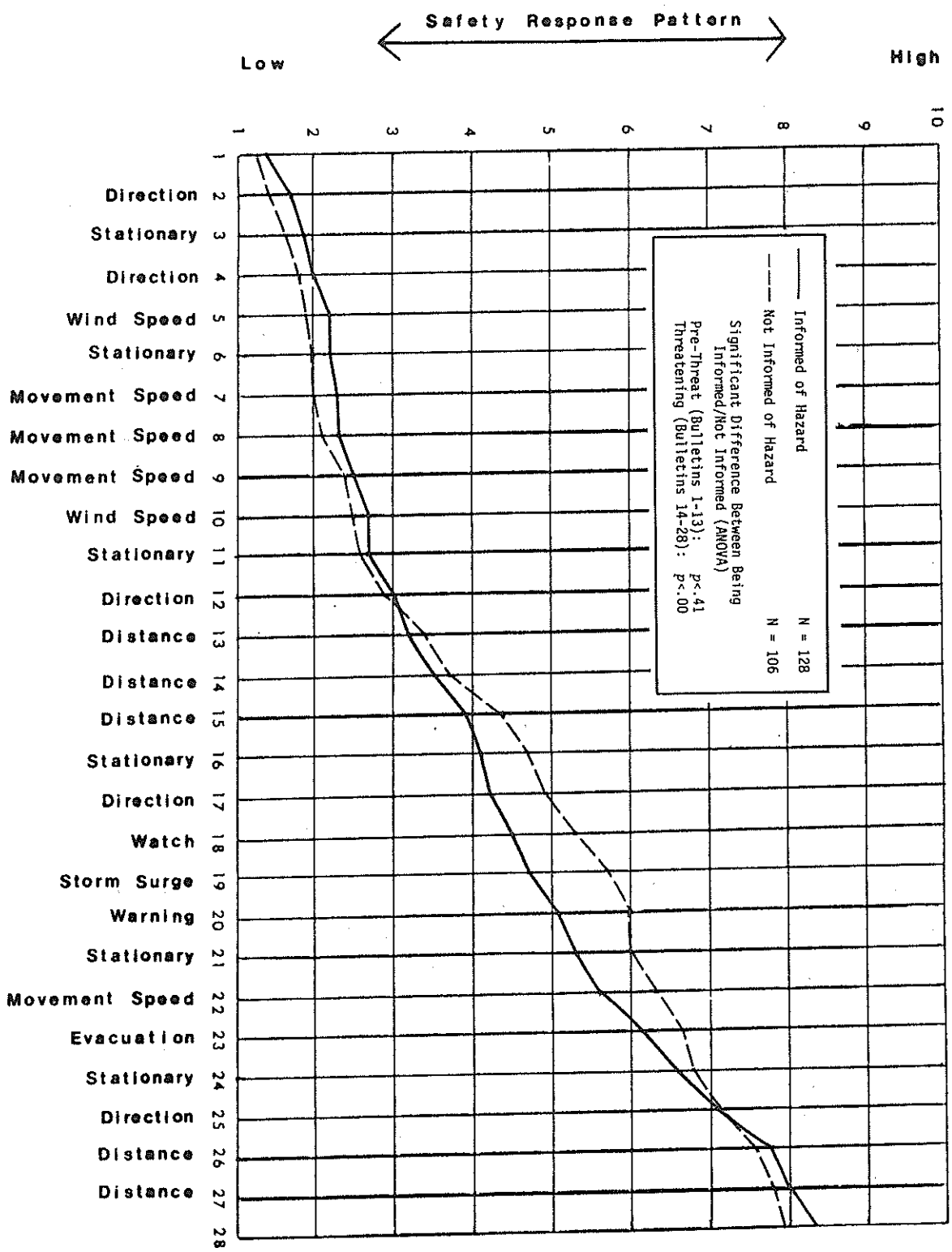

Figure 2-35
Influence of Home Purchasers Being Informed of Possible Hurricane Hazard on Response Patterns

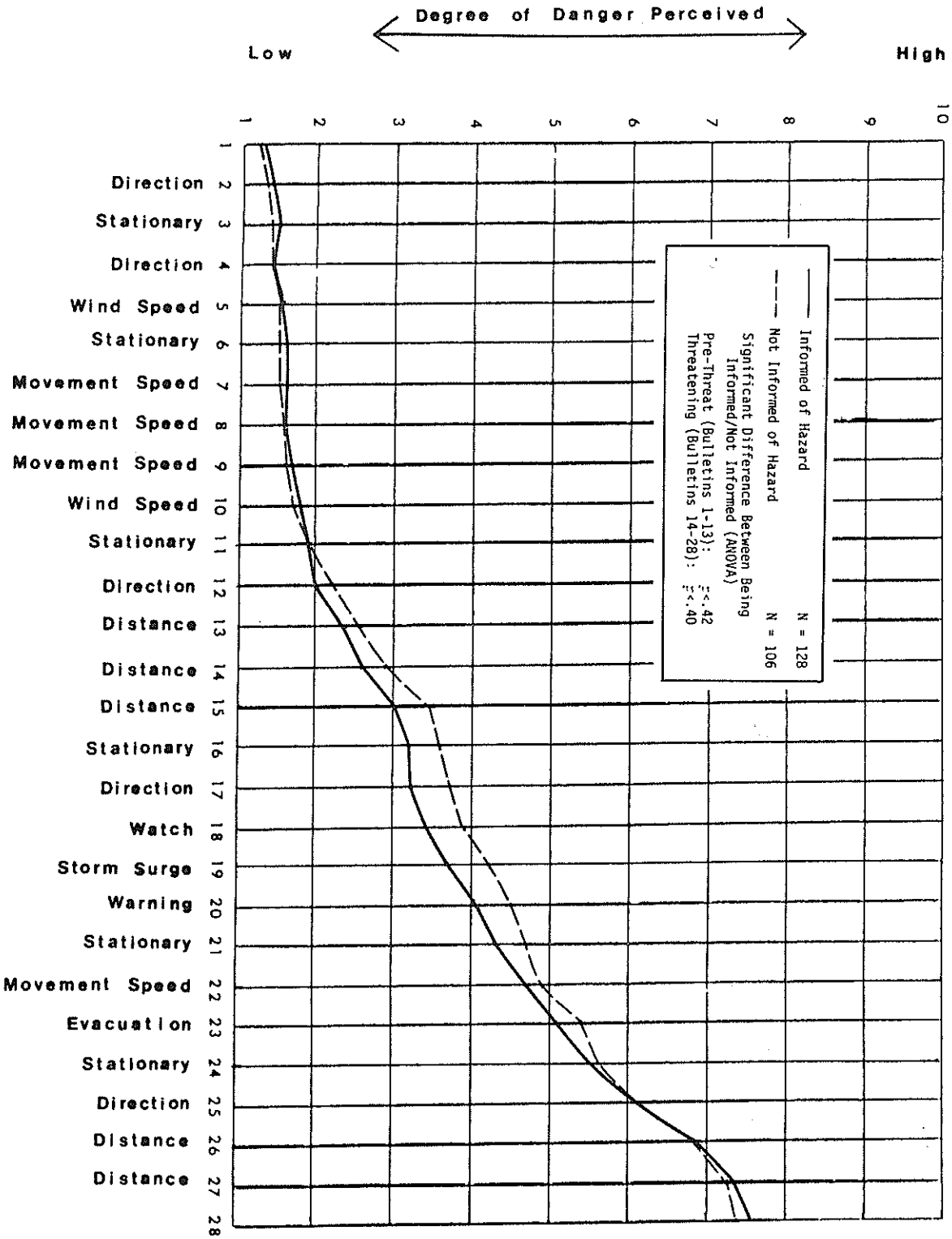

Figure 2-36
Influence of Home Purchasers Being Informed of Possible Hurricane Hazard on Perception of Danger

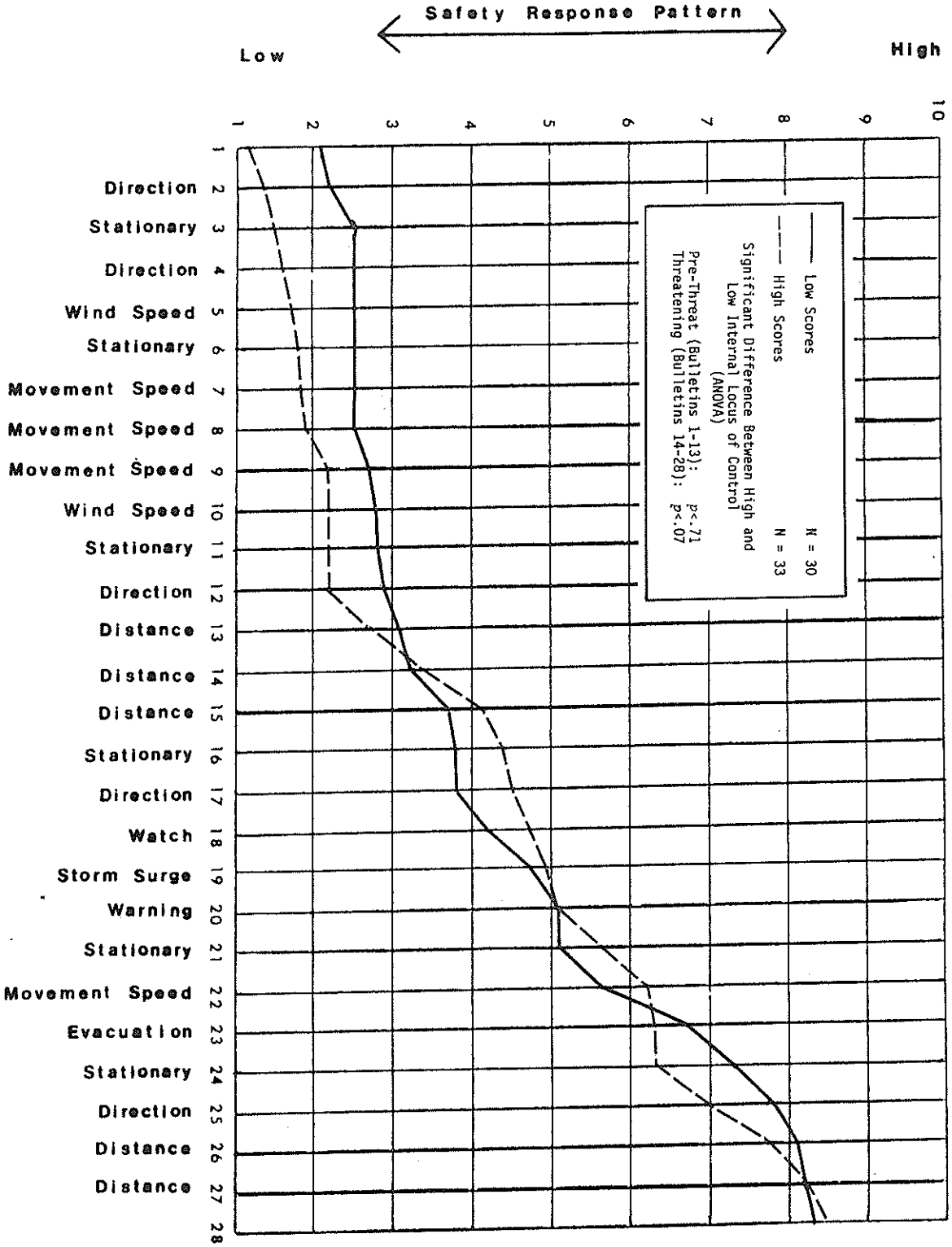

Figure 2-37
Influence of Internal Locus of Control on
Response Patterns

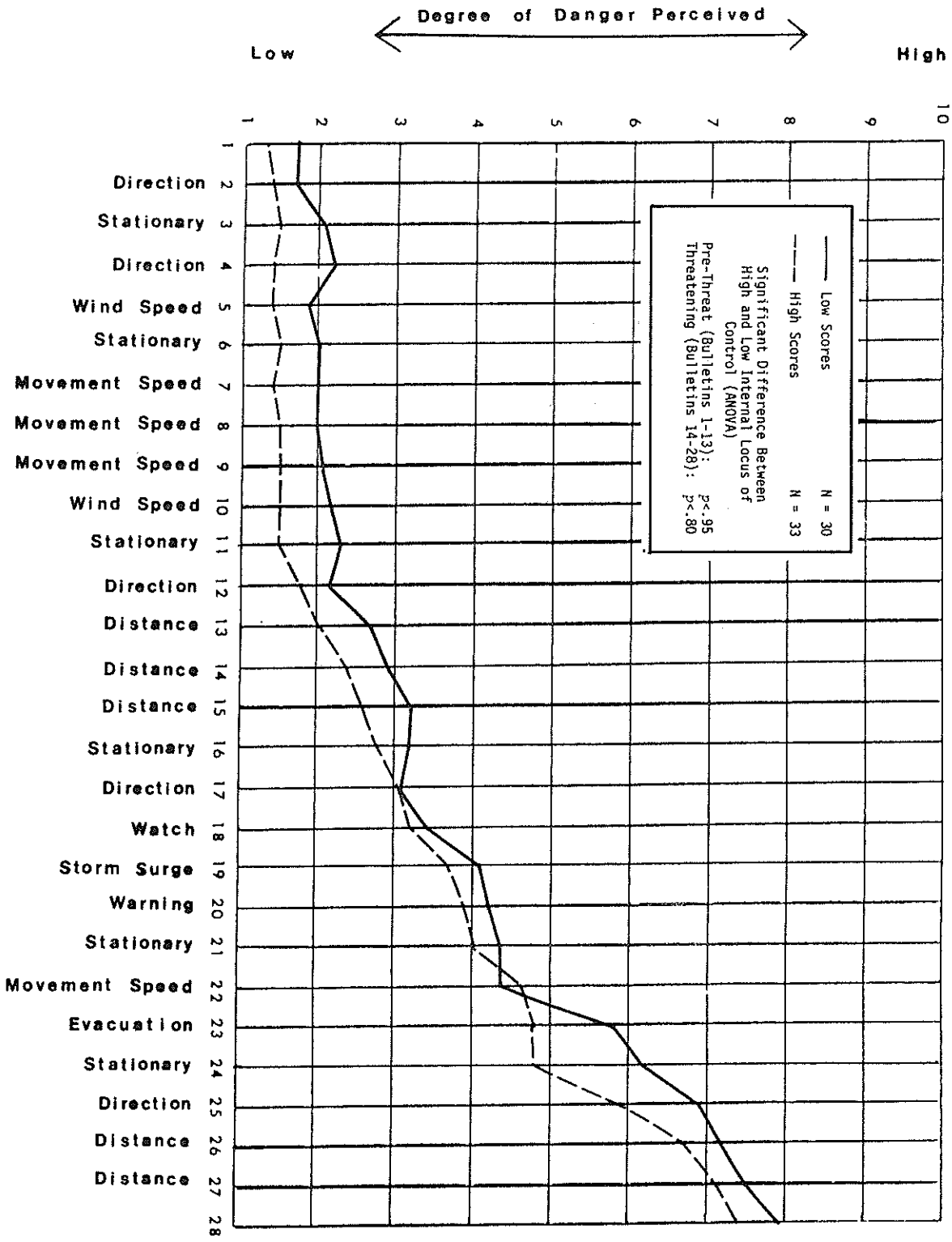

Figure 2-38
Influence of Internal Locus of Control on
Perception of Danger

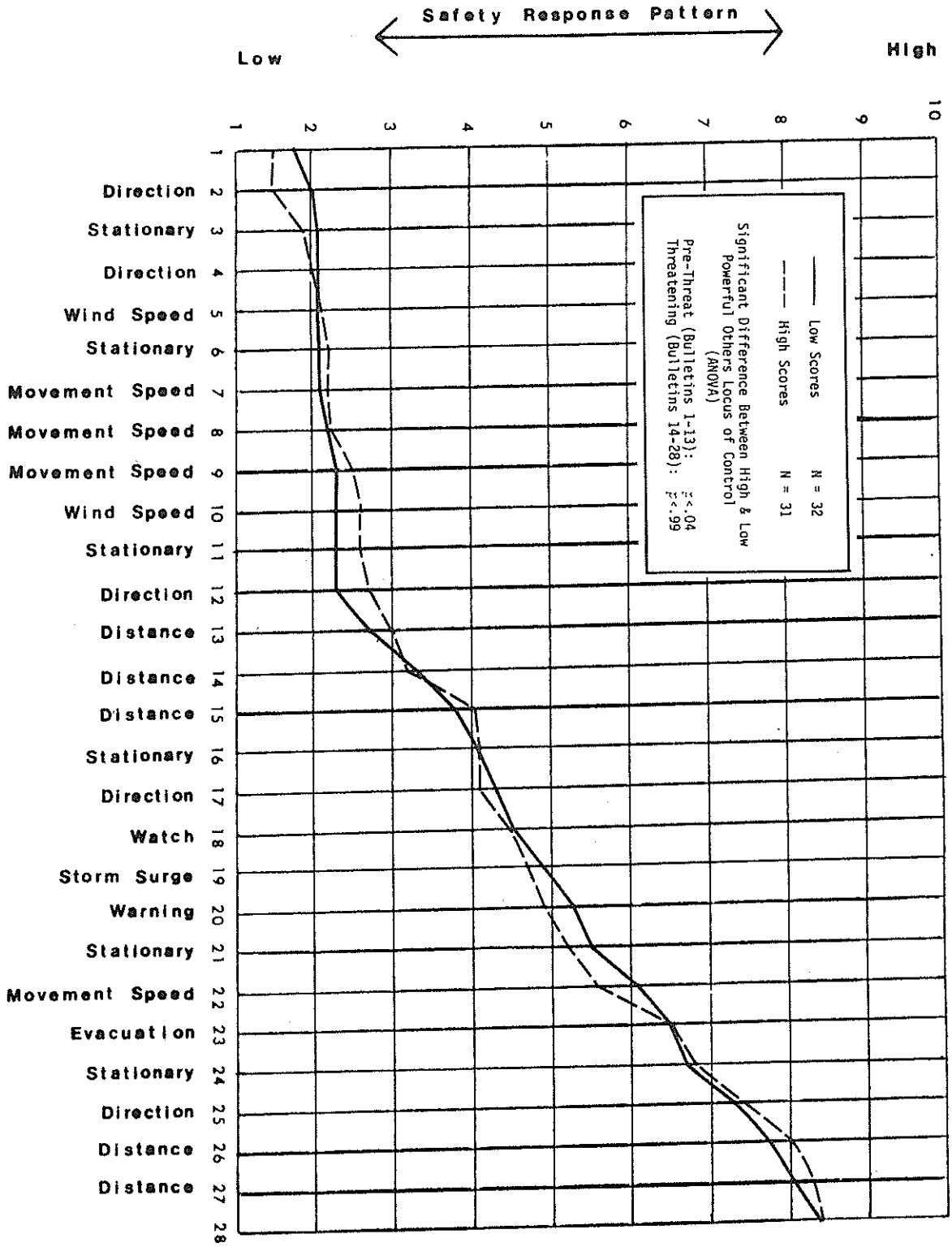

Figure 2-39
Influence of Powerful Others Locus of Control on
Response Patterns

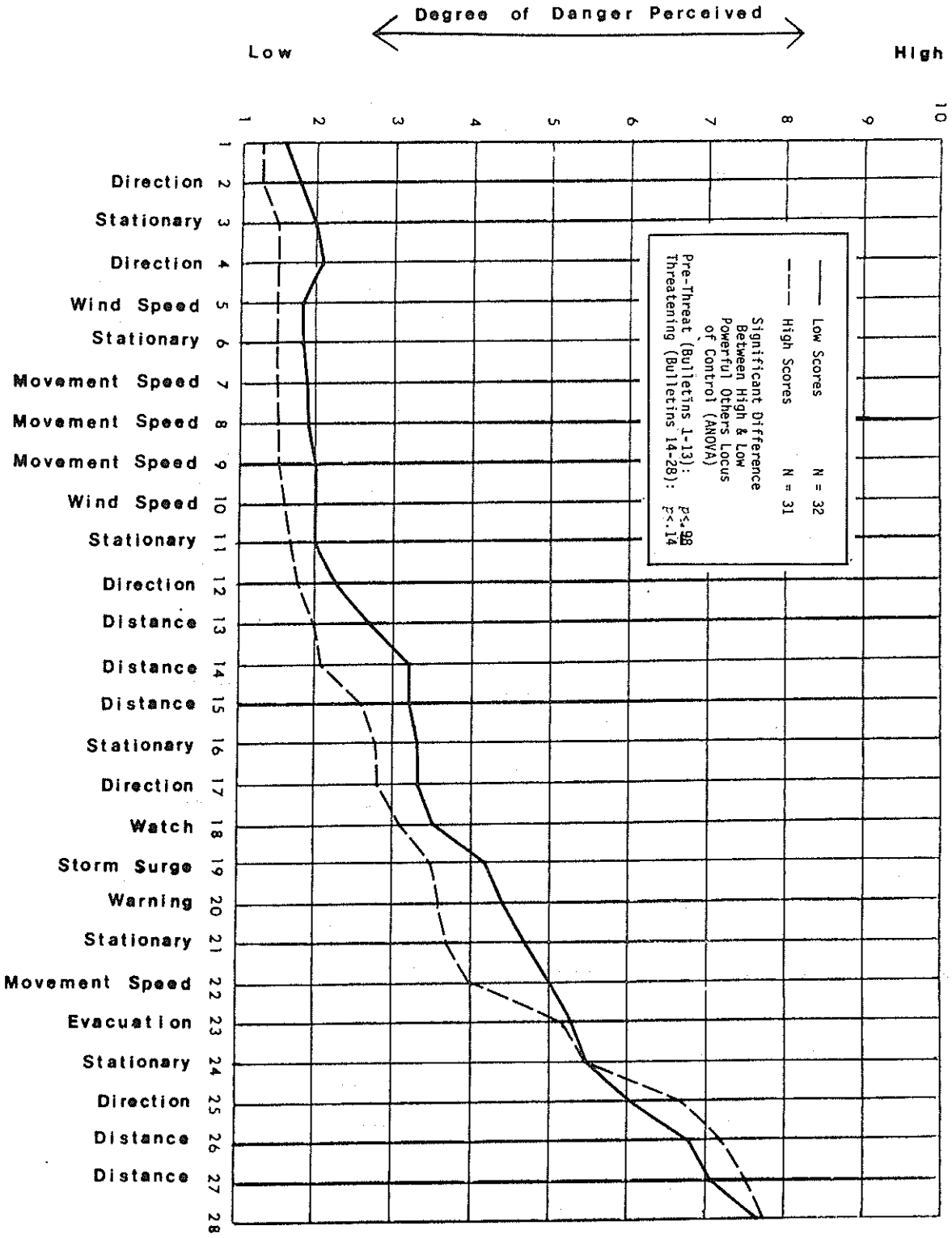

Figure 2-40
Influence of Powerful Others Locus of Control on
Perception of Danger

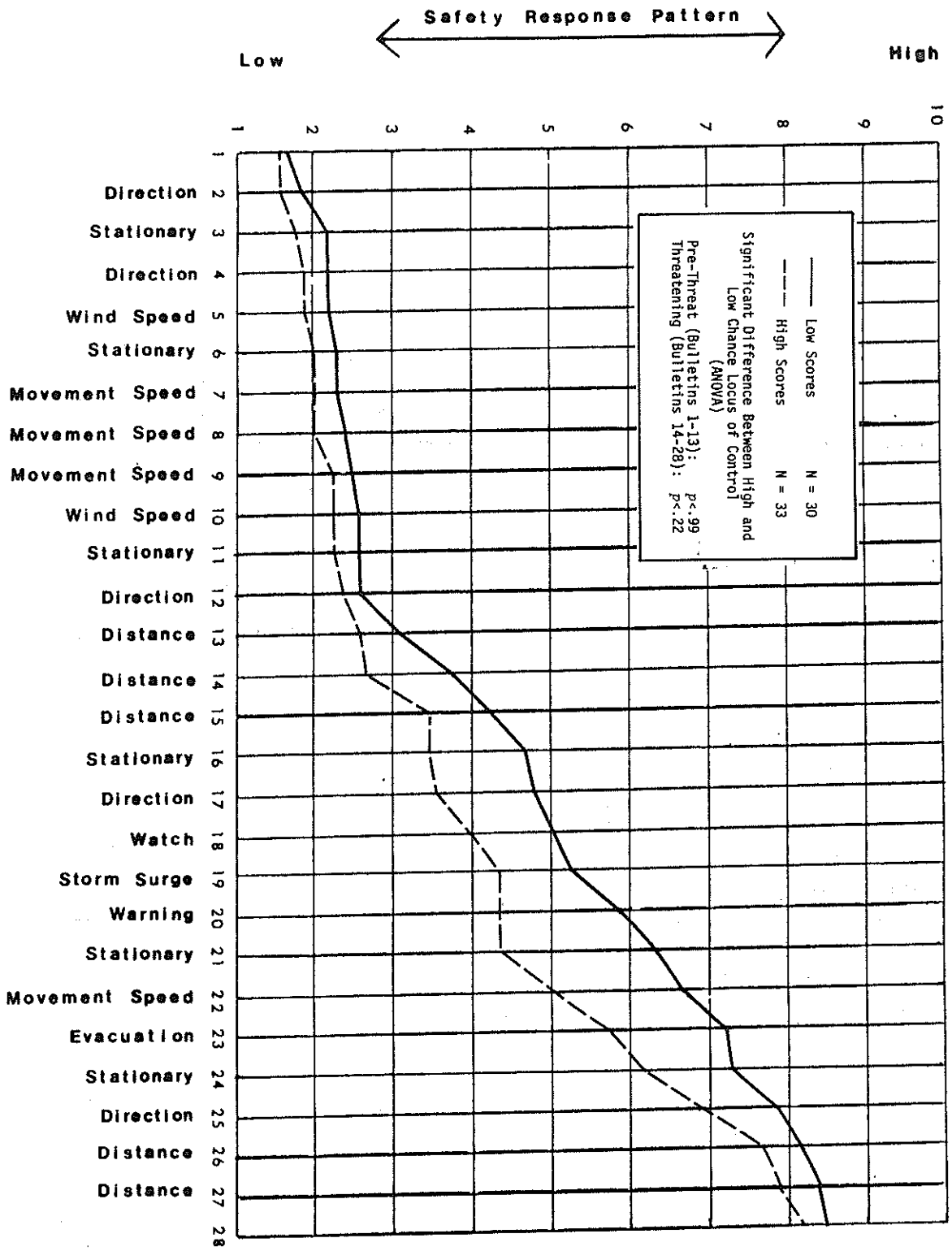

Figure 2-41
Influence of Chance Locus of Control
On Response Patterns

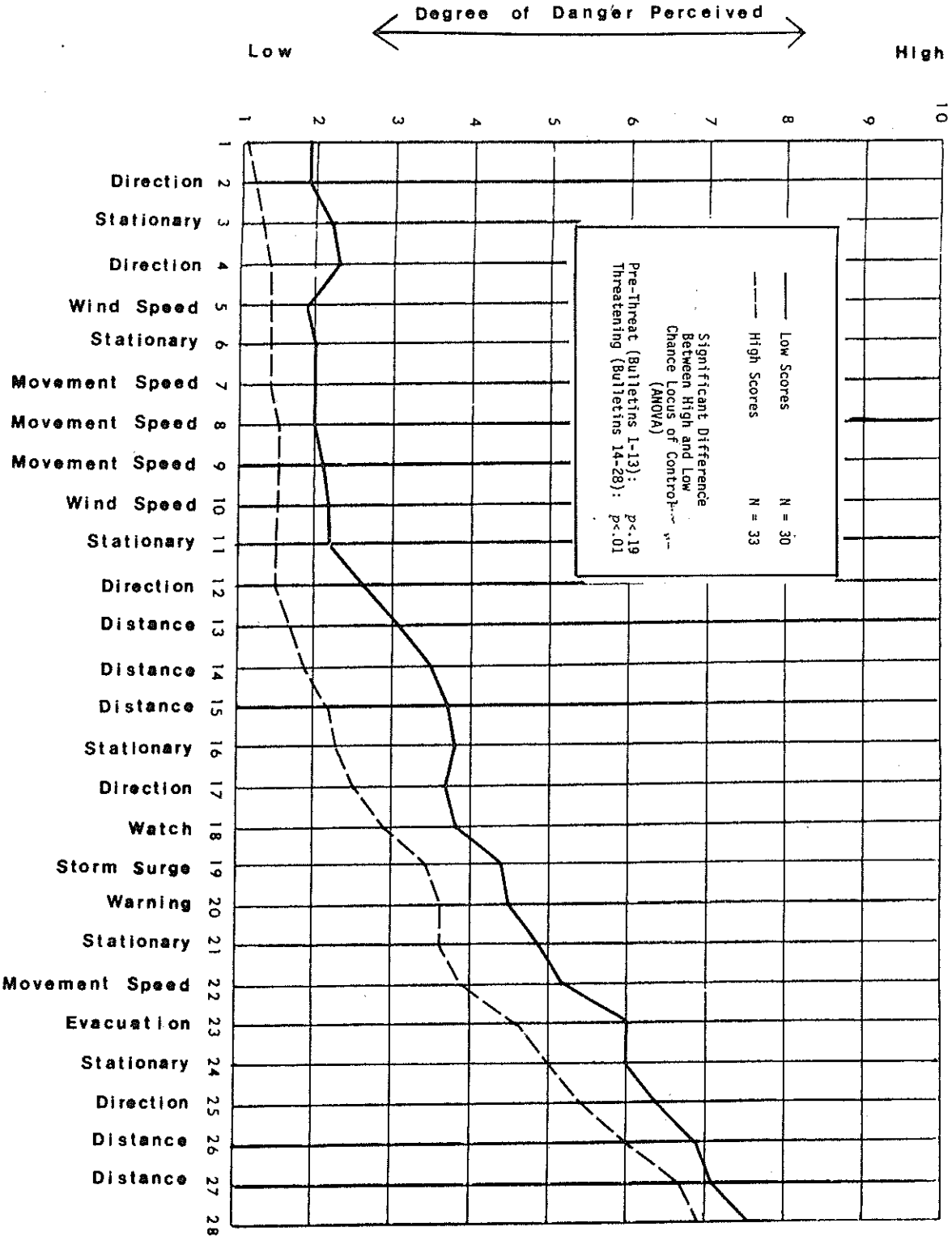

Figure 2-42
Influence of Chance Locus of Control on
Perception of Danger